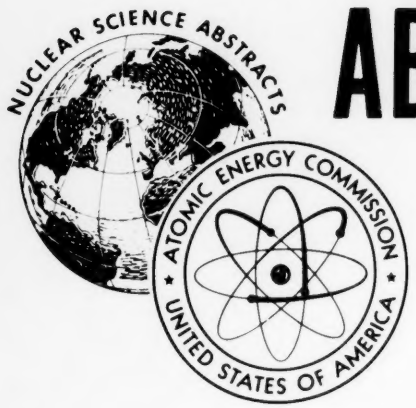
NUCLEAR SCIENCE ABSTRACTS



Volume 27 Number 12

Abstracts 27283-29925

June 30, 1973

UNITED STATES ATOMIC ENERGY COMMISSION

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NOTICE

A title page for Volume 27, Numbers 7–12, is included at the back of this issue for use in binding those issues.

CORRECTIONS

NSA Vol. 26, No. 15, Abst. 37448, line 8 should read: tions for 13 proton groups from the $^{21}Ne(d,p)^{22}Ne$ reaction at 3.3

NSA Vol. 27, No. 3, Abst. 5298 should be replaced with:

The construction of the canal-cooling reservoir system for two of the nuclear reactors was undertaken in 1957. Prior to that time, heated effluents from these reactors were discharged into the headwaters of Lower Three Runs Creek. The major reservoirs in the system include Pond B (200 acres) and Par Pond (2800 acres), which includes Pond C (170 acres). A series of biological surveys was initiated in 1951. Data are presented on the change in fish species composition in a section of lower Three Runs Creek since impoundment. A list of the fish species collected to date in the cooling reservoir system was made in order to provide a base line of species for investigators unfamiliar with the fauna of the area and to show additional fish species that may be found during a continuing biological survey. Differences in species numbers between cooling reservoirs in the system probably result from different thermal histories of the reservoirs. Some differences in species collected may be due to the sampling techniques employed. (CH)

NSA Vol. 27, No. 7, Abst. 14732, line 3 should read: Magmatic Thorium-Rare Metal Deposits). Nevskii, V. A. (ed.).

Volume 27, Number 12, June 30, 1973

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Office of Information Services, John A. Harris, Director.
Published by the USAEC Technical Information Center, Robert L. Shannon, Manager.

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Atomic Energy Commission and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted:

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NEWKIRK, L. R., Superconductivity in the pseudobinary alloys V_3Si--Nb_3Al, 25:1093 (CALT-822-13)
NEWLAND, E. A., Radiation treatment of sewage, 25:140 (AAEC/LIB/81b-254)

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The subject index consisting of specific materials, objects, and processes is arranged alphabetically. Modifying phrases specific to these subjects in turn are arranged alphabetically under the subjects.

TRANSURANIUM ELEMENTS
determination in bone ash, radiochemical method for, 25:40 (IDO-12073, pp 28-36)
separation by ion exchange and complex-formation elution, 25:251(P)
TRIETHYLENETETRAMINE
complexes with cobalt(III) and rhodium(III) chlorides, radiation effects on labeled, thermal-neutron, 25:137
TRITIUM
content in Cattaraugus Creek near West Valley Processing Plant, July through Dec. 1969, 25:258 (DOCKET-50201-48)
content in Cattaraugus Creek near West Valley Processing Plant, Jan. to July 1970, 25:259 (DOCKET-50201-49)
determination in luminescent material by scintillation counting, 25:40 (IDO-12073, pp 28-36)

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Technical report literature is indexed from the name of the organization or institution responsible for the issuance of the report.

372 (UCRL-72739) CONSTRUCTION OF A UNIQUE UNDERGROUND WHOLE BODY COUNTER. Griffith, R. V.; Anderson, A. L.; Lindeken, C. L. **(California Univ., Livermore. Lawrence Radiation Lab.).** Oct 1970. 27p. (CONF-701009-1). Dep. NTIS.

is indexed as:

CALIFORNIA UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Construction of a unique underground whole body counter, 25:372 (UCRL-72739)

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30(Pt.2)	25-331	Dep. NTIS
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Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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Volume 27, Number 12 June 30, 1973

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

27283 STUDY OF SPECTRAL AND KINETIC CHARACTERISTICS OF SHORT-LIVED PARTICLES IN A SOLID PHASE. Shubin, V. N.; Kabakchi, S. A.; Pernikova, T. E.; Sharanin, Yu. I.; Dolin, P. I. (Inst. of Electrochemistry, Moscow). pp 1151-1161 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517-(Vol.2).

Analytical Chemistry

Refer also to abstracts 27684, 27785, and 28117.

27284 (RDT-F-3-40-T(1-73)) METHODS FOR THE ANALYSIS OF SODIUM AND COVER GAS. (Division of Reactor Development and Technology (AEC), Washington, D. C.). Jan 1973. 256p. RSO.

This standard provides the sampling and analytical procedures that are to be used in implementing operating and purchase purity specifications for sodium and cover gas of the liquid metal fast breeder reactor. It provides procedures for the following: analysis of sodium and cover gas from reactor primary, secondary, and auxiliary loop systems and from large and small test and experimental systems: analysis of purchased sodium; analysis of purchased cover gas; treatment of data; and, packaging of samples for shipment or storage. (auth)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 28061 and 28067.

27285 (BARC-639) ANNUAL REPORT OF THE ANALYTICAL CHEMISTRY DIVISION, 1971. Das, M. S.; Sathe, R. M. (Comps.). (Bhabha Atomic Research Centre, Bombay (India)). 1972. 114p. Dep. NTIS (U. S. Sales Only) $7.75.

The following neutron activation analysis studies are reported: the determination of Au in ores following separation from Sb and As; the determination of Hg in laterites following radiochemical separation; the determination of rare earths in monazite and thorium compounds; the nondestructive determination of W in low-grade tungstates; the use of a portable Be–Pu source in determinations of Mn in rocks and steel, Na in rocks, Cu in ores, Al and Si in beryl, F in AlF_3, cryolite, and NaF, and Al in AlF_3; and, the determination of As, Au, Mn, Na, and Zn in hair. A procedure for the charged particle activation analysis of F in zircaloy is described. Spectrophotometric methods are reported for the determination of V in diuranates, Nb in carbonatites, and Te in Se. Cadmium was determined in thorium nitrate and uranium by atomic fluorescence. Voltammetric studies were conducted on the reduction of uranyl ions in the presence of trivalent iron in nitric acid solutions and the reduction of Cd^{2+} and Eu^{3+} on ir- and uv-irradiated gold wire electrodes. The effects of acetonitrile concentration on the polarographic behavior of uranyl ions in aqueous NaCl solutions were studied. The polarographic behavior of uranyl ions in aqueous methanol–thiocyanate solutions was also studied. Thermodynamic parameters are reported for uranyl sulfate complexes. (JGB)

27286 (LBL-1291) APPLICATION OF ^{3}He-INDUCED NUCLEAR REACTIONS FOR SENSITIVE CHEMICAL ANALYSIS OF SULFUR, CHLORINE, POTASSIUM, AND CALCIUM. Lee, D. M. (California Univ., Berkeley. Lawrence Berkeley Lab.). Nov 1972. Contract W-7405-eng-48. 38p. Dep. NTIS $4.00.

Thesis.

Three easily-detected radionuclides, ^{38}Cl, ^{34m}Cl, and ^{38}K, produced from ^{3}He reactions on sulfur, chlorine, potassium, and calcium, were used as "signals" for the determination of the latter elements. This method of activation analysis is capable of determining the above elements individually at the microgram level or submicrogram level in some cases. A number of samples were analyzed non-destructively by using differing nuclear reactions to examine the accuracy of the method and the extent of interferences. Experimentally determined absolute excitation functions were measured in the ^{3}He energy range from 3 to 22 MeV for the following nuclear reactions: $^{32}S(^3He,p)^{34m}Cl$, $^{35}Cl(^3He,\alpha)^{34m}Cl$, $^{39}K(^3He,2\alpha)^{34m}Cl$, $^{37}Cl(^3He,2p)^{38}Cl$, $^{37}Cl(^3He,2n)^{38}K$, $^{39}K(^3He,\alpha)^{38}K$, and $^{40}Ca(^3He,\alpha p)^{38}K$. (auth)

27287 TECHNIQUE FOR MEASURING HYDROGEN CONCENTRATION VERSUS DEPTH IN SOLID SAMPLES. Leich, D. A.; Tombrello, T. A. (California Inst. of Tech., Pasadena). Nucl. Instrum. Methods; 108: No. 1, 67-71(1973).

The resonance at 0.83 MeV (center-of-mass energy) in the nuclear reaction $^1H(^{19}F,\alpha\gamma)^{16}O$ has been used to measure hydrogen depth profiles in solids. Hydrogen concentrations have been measured to a depth of 0.4 μm both in samples implanted with 11.5-keV protons and in several lunar samples. Further applications of this technique are discussed and several other resonant nuclear reactions are suggested for depth distribution studies of hydrogen and other elements. (auth)

27288 NONDESTRUCTIVE PROTON ACTIVATION METHOD FOR DETERMINATION OF SULFUR: APPLICATION TO PETROLEUM PRODUCTS. Burton, T. D.; Swindle, D. L.; Schweikert, E. A. (Texas A and M Univ., College Station). Contract AT(40-1)-3922. Radiochem. Radioanal. Lett.; 13: No. 3, 191-198(3 Apr 1973).

A rapid, nondestructive method for determining sulfur via the reaction $^{32}S/p,\alpha/^{29}P$ is presented. The results obtained on a series of crude oil samples ranging from 0.06 to 1.23% are in good agreement with those provided by conventional methods. The detection limit for this proton activation technique is estimated to be ~100 ppM for a 5 μA irradiation of 1 sec duration. (auth)

27289 TOTAL BODY NITROGEN AND PROTEIN BY IN VIVO FAST NEUTRON ACTIVATION ANALYSIS. Nagai, T. (National Inst. of Radiological Sciences, Chiba, Japan). Nucl. Med., Suppl.; No. 9 Suppl., 17-20(1971).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

In vivo 14 MeV fast neutron activation analysis for total-body nitrogen and protein in mice was successfully performed with a high degree of accuracy. An appraisal of this study indicates that this technique is a simple, useful, and nondestructive method for measuring nitrogen and protein in the living body without serious radiation effects. Automated data processing with a digital computer gave highly accurate results. (auth)

27290 ACTIVATION ANALYSIS FOR TRACE ELEMENT CONCENTRATIONS IN HUMAN HEAD HAIR; INFLUENCE OF SEX, AGE, AND ENVIRONMENT. Kasperek, K.; Feinendegen, L. E.; Siller, V. (Kernforschungsanlage, Juelich, Ger.). Nucl.-Med., Suppl.; No. 9 Suppl., 123-126(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).
See CONF-690992--.
From 26 male and female persons, 50 mg hair samples were cleaned with an acetone-methanol mixture. The samples were neutron-activated in the reactor FRJ-1, Juelich at a maximal flux of 7×10^{13} neutrons per cm^2 per sec. The gamma spectra were obtained with NaI(Tl) and Ge(Li) detectors connected to a multichannel analyzer. Results showed that the trace element content was dependent on age, sex, and pregnancy. It was suggested that trace element concentrations might be useful as indicators of hormonal and metabolic changes. (HBG)

27291 QUANTITATIVE THORIUM DETERMINATIONS IN 30 ORGANS IN HUMAN THOROTRASTOSE. Kampmann, H.; Wesch, H.; Wegener, K. (Univ., Heidelberg). Nucl.-Med., Suppl.; No. 9 Suppl., 579-585(1971). (In German).
From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).
See CONF-690992--.
By means of neutron activation analysis, quantitative thorium determinations were performed on 30 organs and tissues of five patients treated with thorotrast. The measurements were compared with autoradiographic findings. With only one exception, neutron activation analysis detected measurable, but strongly variable, amounts of thorium in organs and tissues. The detection limit lay at 0.2 μg thorium/g tissue. Autoradiography detected thorium in organs containing more than 10 μg/g tissue. The largest amounts were found in spleen, liver, bone marrow, lymph glands, and adrenal gland. Results of the measurements agreed with modern clinical findings as well as with animal experiments. (tr-auth)

27292 IMPROVED ISOTOPE TAGGING DETECTION PROCEDURES FOR SYNTHETIC FIBERS USING THE LEPD DETECTOR. Weaver, J. N.; Manohar, H. (North Carolina State Univ., Raleigh). Text. Res. J.; 42: No. 11, 681-688(Nov 1972).
A new type of nuclear detector known as a low-energy photon detector (LEPD) has been developed by the nuclear industry. It will enable textile firms to optimize the technique of neutron activation analysis as applied to the tagging of synthetic textile monofilaments with rare earths and other elements. The sensitivity and resolution of the LEPD show that, under various parameters, europium, samarium, gadolinium, terbium, dysprosium, holmium, erbium, ytterbium, lutetium, and palladium all are excellent textile tagging possibilities. (auth)

27293 INVESTIGATION OF THE FEASIBILITY OF DETERMINING IMPURITIES OF MANGANESE ORE AND FERROALLOYS USING NEUTRON GENERATORS. Gordadze, G. P.; Gvakhariya, V. V.; Zakharov, E. A.; Megrelishvili, K. Ya.; Soseliya, A. A.; Kabulashvili, V. G.; Kintsurashvili, V. I. (Inst. of Physics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 69: No. 2, 297-300(Feb 1973). (In Russian).
Methods were developed for the determination of silicon, phosphorus, sulfur, and iron in manganese ores and ferroalloys, using neutron generators. These methods enable analysis—with an accuracy not less than that obtained in chemical analysis—of the mentioned elements during 30 minutes and, should a necessity arise, to make a complete chemical analysis. (auth)

27294 ACTIVATION ANALYSIS OF A SUBSTANCE IN MOTION WHEN USING A FAST NEUTRON SOURCE. Strel'chenko, V. V.; Yakubson, K. I. At. Energ. (USSR); 34: No. 3, 201-202(Mar 1973). (In Russian).
An equation is offered for the intensity of activation irradiation of a moving substance as different velocities of motion, and the resulting intensity was studied as functions of density, and geometry of measurement using 14 MeV neutrons. Choice of certain parameters resulted in a simplification of the method. (KSW)

27295 USE OF A MICROTRON FOR THE RAPID γ-ACTIVATION ASSAY OF ORE SAMPLES FOR GOLD. Kapitsa, S. P.; Martynov, Yu. T.; Sulin, V. V.; Tsipenyuk, Yu. M. At. Energ. (USSR); 34: No. 3, 199-200(Mar 1973). (In Russian).
The short-lived isomer ^{197m}Au which is formed in a (γ,γ)-activation reaction was employed as a basis for an analytical method for Au in samples of ore. The energy released has a maximum at 277 keV. A casette containing 100 g of ore was irradiated in a microtron for 18 sec at an average current of 30 μA of electrons. A scintillation counter with a 70 × 70 mm crystal of NaI(Tl) yielded satisfactory results, with a threshold sensitivity of at least 7×10^{-4}%. (KSW)

27296 SYSTEMATIC ERRORS IN 14-MeV NEUTRON ACTIVATION ANALYSIS FOR OXYGEN. Part I. Neutron and γ-ray Attenuation Effects. Vandecasteele, C.; Van Grieken, R.; Gijbels, R.; Speecke, A. (Univ., Ghent). Anal. Chim. Acta; T: No. 2, 187-196 (Apr 1973).
A detailed account is given of neutron and γ attenuation effects in 14-MeV neutron activation analysis for oxygen. Appropriate neutron cross-section values were determined in two different ways and compared with literature values. It appears that the attenuation process is best described in terms of nonelastic scattering cross sections. It is also shown that the narrow beam total γ attenuation coefficients at 6 MeV, given in the literature are suitable for correction purposes if ^{16}N γ rays are counted with a window of 4.5 to 6.5 MeV. Attention was paid to the contribution of β rays when the ^{16}N activity is counted in this energy interval with a NaI(Tl) detector. (auth)

27297 DETERMINATION OF IMPURITIES IN PLATINUM BY ACTIVATION ANALYSIS. Foerster, H. (Forschungsinstitut fuer Ne-Metalle, Freiburg, i. B.); Goerner, W. Isotopenpraxis; 8: No. 11-12, 445-449(1972). (In German).
A report is presented on the determination of Cu, Au, Ir, Os, and Ru in platinum by activation analysis using a radiochemical separation and gamma-spectrometric radiation measurement. A radiochemical separation process consisting in revolatilization of the tetroxides of Os and Ru, elimination of the matrix activity by adsorption of an anion exchanger, extraction of Au, Cu, and other elements in the form of chloro-, DDTC, and BPHA complexes is developed. The possibilities of applying this separation process to the activation analysis are discussed. The specification and results of the analysis of some platinum samples with impurity contents in the range of 0.05 to 400 ppM are given. (auth)

27298 NUCLEAR APPLICATIONS IN ART AND ARCHAEOLOGY. Perlman, I.; Asaro, F.; Michel, H. V. (Univ. of California, Berkeley). Annu. Rev. Nucl. Sci.; 22: 383-426(1972).
The first part of the review concerns studies of provenience (where objects were made). The provenience of pottery, obsidian, glass, coins, and other metals is considered, as well as the method using isotopic ratios such as lead isotope ratios, carbon and oxygen in marble, and oxygen isotopes in glass. The second part deals with dating. Radiocarbon dating is discussed in some detail; dating materials, calibration, and various problems encountered in using the method are included. Thermoluminescence, fission track dating, and other dating techniques are also covered. Neutron activation analysis has been applied to the study of paint pigments with some success in establishing age, provenience, and authenticity of oil paintings. (6 figures, 5 tables, 204 references). (RWR)

27299 THIN FILM CHARACTERIZATION BY NUCLEAR MICROANALYSIS. Ziegler, J. F. (IBM Watson Research Center, Yorktown Heights, NY). J. Vac. Sci. Technol.; 10: No. 1, 153-154(1973).
Nuclear microanalysis is a nondestructive method for quantitatively profiling the constituents of thin films. It needs no calibration samples. It excels in determining atomic concentrations with depth in finding reactions and diffusions across interfaces, and in detecting contamination. A summary is given of recent work in the fields of dielectric films, metal alloy films, and profiling impurities in semiconductors. (auth)

27300 APPLICATIONS OF OXYGEN ACTIVATION ANALYSIS TO POLYMERS. Fougea, D.; Ghaleb, M.; Gerard, P.; Pineri, M. (CEN, Grenoble, France). Rev. Gen. Caout. Plast.; 49: No. 11, 1063-1066(Nov 1972). In French).
Oxygen activation analysis has many advantages over the more standard infrared spectroscopy and chemical analysis for the determination of the oxygen content of polymers. The method is specific, rapid, nondestructive, and yields an accuracy of between 4 and 5%. The principles of this type of analysis using 14-MeV neutrons are discussed. Examples involving materials ranging from the pure polymer to finished industrial products and methacrylic acid–butadiene copolymers are presented. This method offers an original solution to the determination of the amount of oxygen on the surface of a degraded polymer, the particular case of the natural degradation of polypropylene being discussed. (France)

27301 SPECTROPHOTOMETRIC STUDY OF THE REACTION OF URANIUM(VI) WITH p-NITROPHENYLFLUORONE. Shchemeleva, G. G.; Bagdasarov, K. N.; Stepanenko, Yu. V. (Rostov-on Don State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 16: No. 2, 198-201(1973). (In Russian).
p-Nitrophenylfluorone (NPF) formed a red complex immediately with U(VI) which did not change with time, and became the basis for a determination of U at a pH of 6.0 to 6.2 in solutions of the pure salt. The complex had the formula $UO_2(NPF)_2$, and a molar extinction coefficient of 2.2×10^4. The selectivity of the U–NPF reaction was studied in the presence of nine extraneous cations and nine different anions. (KSW)

27302 RADIOCHEMICAL SEPARATION OF FLUORINE BY FIXING ON A LEAD STRONTIUM HYDROXYAPATITE. Debove,

L. (CNRS, Vitry-sur-Seine, France). Compt. Rend., Ser. C; 275: No. 20, 1189-1192(13 Nov 1972). (In French).

The conditions for fixing radioactive fluorine on a lead strontium hydroxyapatite in the presence of Al were studied. Fluorine can be quantitatively fixed by complexing Al with sodium citrate at a pH of between 8 and 9. This type of separation is very selective. It was applied to the determination of fluorine in Al using γ photon activation techniques. (France)

27303 METALLURGICAL APPLICATIONS OF ANALYSIS BY THE DIRECT OBSERVATION OF NUCLEAR REACTIONS. Beranger, G. (Paris Univ., Orsay, France). J. Microscop.; 15: No. 3, 267-284(Dec 1972). (In French).

A method based on recording the energy spectra of particles emitted during nuclear reactions induced by the bombardment of the target under investigation with a beam of deuterons or protons having an incident energy of about 1 MeV is presented. Two cases are considered depending upon whether the light elements (O, C, or N) studied are at the surface or in the first layers of the solid. In the first case, a single spectrum enables the element under investigation to be characterized. In the second case, determinations are made after abrasion or successive chemical attack at the surface of the sample. Some applications are presented: analysis of oxygen present at the surface of Zr after various polishing treatments, effect of annealing on the diffusion of oxygen, the study of the anodic oxidation of metals, and the study of nitride layers formed by the cathode sputtering. (France)

27304 APPLICATION OF THE NEUTRON ACTIVATION ANALYSIS FOR DETERMINING CERTAIN MICROIMPURITIES IN TITANIUM AND FOR STUDYING THEIR BEHAVIOR DURING CORROSION. Uzbekov, A. A.; Akalaev, G. G.; Riskin, I. V.; Likhobabin, V. A. Ind. Lab. (USSR) (Engl. Transl.); 38: No. 7, 1036-1038(Jul 1972).

Translated from Zavod. Lab.; 38: No. 7, 816-818(Jul 1972).

The feasibility of applying neutron activation analysis to the determination of titanium and its impurities as well as to the study of titanium corrosion by means of tracer atoms was investigated. It was found possible to determine Mn, W, Cu, Mo, and Au without chemical separation. It was also shown that using $^{47}Ti(n,p)^{47}Sc$ reaction with a subsequent measurement of the ^{47}Sc γ radiation seems promising as a method of determining titanium and of analyzing its corrosion. (DHM)

Chemical and Spectral Procedures

Refer also to abstract 27571.

27305 (CEA-N-1584) DETERMINATION OF NITROGEN, OXYGEN, AND CARBON IN MIXED U–Pu CARBIDES, NITRIDES, AND CARBONITRIDES. Melamed, J. (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). Dec 1972. 26p. (In French). Dep. NTIS (U. S. Sales Only) $3.50.

The problems encountered, the results obtained, and the accuracies achieved with the following methods are presented: reductive melting in a He atmosphere with or without a Pt bath for the analysis of traces of oxygen and nitrogen in (UPu)C, and oxygen in (UPu)CN and (UPu)N; combustion in a pure oxygen atmosphere for the analysis of C in (UPu)C and (UPu)CN. (auth)

27306 (CONF-720818-, pp 325-334) STABLE STRONTIUM BALANCES IN MAN. Warren, J. M.; Spencer, H. (Western Regional Hospital Board, Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The development in recent years of sensitive methods of trace metal analysis has made it possible to analyze diet and excreta for stable strontium and so establish balance data under normal conditions. Previously, strontium metabolism was studied using radioactive tracers or as in an early study, by the administration of small but nonphysiological amounts of stable strontium. Atomic absorption spectroscopy was used for the determination of stable strontium balances in adult men in control conditions and during oral and intravenous administration of the element. (auth)

27307 (EUR-4927) AUTOMATIC DEVICE FOR SEPARATION OF URANIUM AND PLUTONIUM FROM SPENT NUCLEAR FUEL BY ION EXCHANGERS FOR MASS SPECTROMETRY. Bol, D.; Brandalise, B.; Bier, A.; de Rossi, M.; Koch, L. (European Inst. for Transuranium Elements, Karlsruhe (West Germany)). Mar 1973. 19p. (In German). Dep. NTIS (U. S. Sales Only) $3.00. EUR BF 40,-.

An automatic device was developed which separates uranium and plutonium from nuclear fuel for their isotope analysis. Up to six samples can be separated by ion exchangers simultaneously. The addition of wash and elutrient as well as the collection of up to five fractions per column is automated. The volumes of wash, elutrient and fractions can be chosen individually for each column. The filling of the column is controlled by a light barrier. Pumps, valves and fraction collectors are operated by a control unit based on the digital technique. (auth)

27308 (NLCO-tr-12) PRECISE DETERMINATION OF URANIUM. Cattin, G.; Hugon, J. (Commissariat a l'Energie Atomique, Pierrelatte (France)). Translation from pp 217-225 of STI/PUB-291. (CONF-711107-13). 1972. 9p. Dep. NTIS.

From Symposium on analytical methods in the nuclear fuel cycle; Vienna, Austria (29 Nov 1971).

The development of a method of liquid phase chromatography in columns of Kel F impregnated with tributyl phosphate is described. Excellent results were obtained; the separation efficiencies of more than 99.99% have made it necessary to re-examine and improve the standard redox titration. Under these conditions the reproducibility is: 0.04% for a single determination. For a series of four tests the standard deviation is 0.0138 and the accuracy approximately 0.03% taking into account the calibration which is done with metallic uranium having a total impurity concentration of less than 50 ppM. For the latter operation tests are in progress aimed at using iron with an even better known degree of purity (99.999%). (auth)

27309 RARE EARTHS IN THE APATITE IRON ORES OF LAPPLAND TOGETHER WITH SOME DATA ABOUT THE Sr, Th, AND U CONTENT OF THESE ORES. Parak, T. (Luossavaara Kiirunavaara AB, Kiruna, Sweden). Econ. Geol.; 68: No. 2, 210-221(1973).

The rare earth metal (REM) content in some of the apatite-bearing iron ore deposits in Northern Sweden was studied. The results are presented in two groups. The first group includes 19 specimens with the percentage of phosphorus varying between 4.91 and 17.57, in which the rare earth metal content is as follows: Kiirunavaara 6,560 ppM, Malmberget 5,760 ppM, Leveäniemi 1,545 ppM, Rektorn 3,275 ppM, Haukivaara 5,295 ppM, Henry 5,210 ppM, Nukutusvaara 6,730 ppM, and Lappmalmen 5,890 ppM. The second group comprises 44 samples from a drilled cross section in the Lower Hauki ore-bearing rock series. The correlation between the phosphorus and rare earth metal assays in the samples suggests that most of the rare earth content is associated with phosphate minerals. The rare earth metal content of the apatite–iron ores is between that of the Kola peninsula (USSR) apatites and the apatites in granite–pegmatites. The rare earth metal content in sedimentary and metamorphic rocks is commonly about the same as in the apatite–iron ore from Northern Sweden. The distribution of the rare earths suggests that the apatite–iron ores of Lappland are not of magmatic origin. Values for the content of Sr, Th, and U of these Lappland ores are also tabulated. (auth)

27310 PHYSICAL CHEMISTRY, SERIES ONE. Volume 12. Analytical Chemistry. Part 1. West, T. S. (ed.). MTP International Review of Science. Baltimore; University Park Press (1973). 313p. $24.50.

Separate abstracts were prepared for five of the nine papers presented in this review book. The other form papers discuss: electron spectroscopy for chemical analysis; atomic fluorescence spectroscopy; kinetic methods of analysis; and microwave spectroscopy. (ERB)

For abstracts of individual papers see: 27311–27314 and 27348.

27311 ATOMIC ABSORPTION SPECTROSCOPY. Semb, A. (Norwegian Inst. for Air Research, Kjeller). pp 45-122 of Physical Chemistry, Series One. Volume 12. Analytical Chemistry. Part 1. West, T. S. (ed.). Baltimore; University Park Press (1973).

The recent literature (1969 to 1971) on atomic absorption spectroscopy is reviewed. Among the topics included in the review are: spectroscopic and fundamental studies; instrumentation and methodology; interferences in flame atomic absorption spectroscopy; flameless atomic absorption; and applications. 209 references. (ERB)

27312 ION-SELECTIVE ELECTRODE ANALYSIS. Tenygl, J. (Inst. of Polarography, Prague). pp 123-159 of Physical Chemistry, Series One. Volume 12. Analytical Chemistry. Part 1. West, T. S. (ed.). Baltimore; University Park Press (1973).

The theory and practice of ion-selective electrode analysis are reviewed. Among the topics included in the review are: ion-selective electrodes; reference electrodes; techniques of analytical measurement; classification of ion-selective electrodes; and analytical applications of ion-selective electrodes and commercially available models. 316 references. (ERB)

27313 CATALYTIC METHODS OF ANALYSIS. Yatsimirskii, K. B. (Academy of Sciences, Kiev). pp 193-215 of Physical Chemistry, Series One. Volume 12. Analytical Chemistry.

Part 1. West, T. S. (ed.). Baltimore; University Park Press (1973).

The theory and practice of kinetic methods of analysis using catalytic reactions are reviewed. Topics included in this review of catalytic methods of analysis are: basic requirements; oxidation-reduction reactions; heterolytic reactions; enzyme-catalyzed reactions; and future development of catalimetry. 179 references. (ERB)

27314 MOLECULAR FLUORESCENCE SPECTROSCOPY. Guilbault, G. G. (Louisiana State Univ., New Orleans). pp 217-249 of Physical Chemistry, Series One. Volume 12. Analytical Chemistry. Part 1. West T. S. (ed.). Baltimore; University Park Press (1973).

The theory and applications of molecular fluorescence spectroscopy are reviewed. Among the topics discussed in the review are: introduction to luminescence; instrumentation; structural and environmental effects; phosphorescence; determination of inorganic ions; and determination of organic compounds. (ERB)

27315 PHYSICAL CHEMISTRY, SERIES ONE. Volume 13. Analytical Chemistry. Part 2. West, T. S. (ed.). MTP International Review of Science. Baltimore; University Park Press (1973). 267p. $24.50.

Separate abstracts were prepared for seven of the nine papers in this review book. The other two papers discuss methods of organic microanalysis and light scattering methods. (ERB)

For abstracts of individual papers see: 27316–27322.

27316 ORGANIC REAGENTS. Ueno, K. (Kyushu Univ., Fukuoka). pp 43-69 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

Recent developments in organic reagents for inorganic analysis are reviewed covering the literature from 1968 through the first quarter of 1971. The developments can be classified into two major categories: new organic reagents including azo compounds, β-diketones, ferroins and arylhydroxylamines, Schiff bases, heterocyclic compounds, sulfur donor reagents, and miscellaneous compounds; and the combined use of known reagents including uses of mixed liquid complexes, use of ion association extraction, and complexation in the presence of micelles. (ERB)

27317 THERMOMETRIC ANALYSIS. Beezer, A. E. (London Univ.). pp 71-93 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

Thermometric methods of analysis may satisfy one of the present day needs of analytical chemistry, namely simple, rapid methods, that can easily be automated for routine work. As is usual, kinetic methods of analysis and catalytic means of end-point indication allow increased flexibility in the design of experiments. Development in this area, perhaps specifically in the field of functional group analysis, is to be expected. The possible disadvantage of lack of specificity may be overcome by ingenuity and perhaps more importantly for a wide range of analytical problems by utilizing enzymatic and microbiological systems in flow microcalorimetric experiments. Trace materials, natural materials, enzyme activity, enzyme substrates, inhibitors, and promoters are accessible through flow microcalorimetry. Analyses on as little as 1 μM of reagent are possible and inhibitor concentrations of about 10^{-9} M have been measured. Reactions which are not of zero order may be used for analytical purposes. However, the greatest bar to large scale exploitation of these techniques lies in the general lack of commercial equipment. (auth)

27318 X-RAY FLUORESCENCE ANALYSIS. Jenkins, R. (Philips Electronic Instruments, Mount Vernon, NY). pp 95-126 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

The literature published between January 1969 and November 1971 dealing with the subject of x-ray fluorescence analysis is reviewed. The theory and applications of x-ray fluorescence analysis are reviewed under the following headings: New trends; use of x-ray emission spectra for the study of chemical bonding; basic theory; quantitative methods; instrumentation; energy dispersion analysis; sample preparation; and applications. 460 references. (ERB)

27319 MASS SPECTROMETRIC ANALYSIS. Robertson, A. J. B. (King's Coll., London). pp 127-151 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

The subject of mass spectrometric analysis is reviewed under the following headings: instrumental developments; ion cyclotron resonance mass spectrometry; use of new methods of ionization in analytical investigations; mass spectrometry of negative ions; analysis of gases; analysis of upper atmosphere; analysis of liquids; analysis of solids; analysis of surface layers on solids; analysis of lunar samples and cosmochemistry; high-resolution mass spectrometry; gas chromatography and mass spectrometry; plasma chromatography-mass spectrometry; trace analysis; use of computers in mass spectrometry; some topics in organic mass spectrometric analysis; and clinical, medical, and forensic applications of mass spectrometry. 126 references. (ERB)

27320 FLAME EMISSION SPECTROMETRY. Pungor, E.; Polos, L. (Technical Univ., Budapest). pp 153-176 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

Recent developments in flame emission spectrometry are reviewed. The following topics are included in the decision: composition of flames; development of measuring techniques; temperature of flames; processes taking place in the flame; effects of electrical fields on flame spectra; and practical applications of flame photometry. 213 references. (ERB)

27321 THERMAL METHODS OF ANALYSIS. Wendlandt, W. W. (Univ. of Houston, TX). pp 177-200 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

The nomenclature and instrumentation for thermal methods of analysis are reviewed. Purity determinations using thermal methods of analysis and applications in health sciences, volatility studies, lunar fires, analytical chemistry, and medicine are discussed. 80 references. (ERB)

27322 ELECTROCHEMICAL METHODS OF ANALYSIS. Hulanicki, A. (Univ., Warsaw). pp 201-234 of Physical Chemistry, Series One. Vol. 13. Analytical Chemistry. Part 2. West, T. S. (ed.). Baltimore; University Park Press (1973).

The applications of electrochemical methods of analysis in analytical chemistry are reviewed. Included in the discussion are coulometric methods, voltammetric methods, and electrometric end-point detection. 411 references. (ERB)

27323 GRAVIMETRIC DETERMINATION OF URANIUM IN URANYL NITRATE. Vita, O. A.; Walker, C. R.; Litteral, E. (Goodyear Atomic Corp., Piketon, OH). Anal. Chim. Acta; 64: No. 2, 249-257(Apr 1973).

A study of the factors that affect the gravimetric determination of uranium in uranyl nitrate is described. In the gravimetry of uranium, the U_3O_8 (weighing form) produced by ignition is usually assumed to deviate <0.02% from theoretical composition; and elemental impurities are assumed to form common oxides within the U_3O_8 matrix. It was found that these assumptions are incorrect. Ignition temperature and time affect U_3O_8 stoichiometry. Ignitions of uranyl nitrate for 1 to 3 h at 850° produce U_3O_8 that deviates as much as 0.15% from stoichiometric U_3O_8; deviations are negligible when uranyl nitrate is ignited at 1000° for 2 h. Elemental impurities, particularly calcium and phosphorus, affect the composition of U_3O_8 formed in the ignition of uranyl nitrate. A variety of impurity complexes such as uranates and phosphates are found within the U_3O_8 matrix. Formation of these impurity complexes depends on the elements present, their concentration, and ignition temperature. Therefore, in the gravimetric determination of uranium in uranyl nitrate, the effects of ignition parameters and nonvolatile impurities must be considered in order to obtain accurate uranium determinations. (auth)

27324 NEW EXTRACTION-PHOTOMETRIC METHOD FOR DETERMINING URANIUM IN MINERALS. Shchemeleva, G. G.; Bagdasarov, K. N.; Stepanenko, Yu. V. (Rostov State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 15: No. 10, 1468-1470(1972). (In Russian).

The extraction of U(VI) as a complex of n-nitrophenylfluorononе was studied photometrically at λ = 530 nm. The extraction was optimal at a pH of 6.2, and could be rendered more selective by a preliminary extraction with TBP. Thus the U determination could be made in the presence of large quantities of V, Th, and rare earth elements. Explicit directions are given for the application of this method to carnotite. (KSW)

27325 GAS ANALYSIS IN IRRADIATED FUELS AND STRUCTURES. Gayet, B.; Soler, C. (CEN de Cadarache, Saint-Paul-les-Durance, France). Bull. Inform. Sci. Tech. (Paris); No. 175, 39-43(Nov 1972). (In French).

The large quantities of gas formed under irradiation or during fission in reactor components necessitates determinations in irradiated materials. The equipment described is multipurpose and consists of a vacuum furnace for gas extraction, an apparatus for quantitative collection, and a quadripolar probe analyzer. The advantages of the equipment presented are its 60 mm diameter crucible, its ability to handle temperatures up to 2500°C, and

its ability to analyze gases having different atomic masses. (France)

27326 TITRATION OF NONAQUEOUS SOLUTIONS OF THE PERCHLORATES OF SCANDIUM, YTTRIUM, LANTHANUM, AND RARE EARTH ELEMENTS. Kreshkov, A. P.; Milaev, S. M.; Manzhigeeva, V. K. (Chemical-Technical Inst., Moscow). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 16: No. 2, 186-189 (1973). (In Russian).

Potentiometric titration curves were constructed for the perchlorates of Sc, Y, La, Pr, Nd, Sm, Eu, Gd, Tb, Tm, Er, Lu, and for perchloric acid itself, using glass and AgCl electrodes in a 0.1 N KOH solution in butanol. An analytical method was developed on this basis for the individual rare earths with an inherent error of ≤1.00%, or ≤4.00% for mixtures. (KSW)

27327 CALORIMETRY OF CERIUM(III) WITH GLUTARIMIDE DIOXIME. Buscarons, F.; Canela, F.; Iturriaga, H. (Univ., Barcelona). Quim. Ind. (Madrid); 17: No. 5, 6-8(1971). (In Spanish).

A solution of the sample (e.g., a misch metal containing 50% of Ce, 25% of La, 15% of Nd and 10% of Fe) in HNO_3 (1:1) (5 ml), containing 7.5 to 15 mg of Ce(III) is boiled with 1 g of $NaBiO_3$, and the cooled solution is extracted with ethyl ether (2 × 5 ml). The residual aqueous solution is re-oxidised with 0.5 g of $NaBiO_3$ and extracted with 2-ml portions of ether. The combined extracts are treated with H_2O (5 ml), the ether is removed by evaporation, the solution is neutralized, and the precipitated hydroxides are re-dissolved with dilute H_2SO_4. A little aqueous H_2O_2 is added to reduce all the Ce to Ce(III) and excess is removed by boiling. The solution is made up to 100 ml with H_2O, and a 10-ml portion is treated with 3 ml of 0.5% glutarimide dioxime solution in ethanediol and 7 ml of 2M-aqueous-NH_3 and made up to 25 ml with H_2O. After 30 min the extinction is measured at 480 nm. The complex is stable for 5 hr and, at pH 10.3 to 12.2, Beer's law is obeyed with 5 to 120 ppM of Ce(III) in the final solution. If La is present, the Ce must first be separated by extraction, as Ce(IV), with ether from 8M-HNO_3 medium. Errors are <-2%. (Anal. Abstr.)

27328 MODERN ANALYTICAL METHODS OF DETERMINATION AND SEPARATION OF YTTRIUM (SURVEY). Eremin, Yu. G.; Bondarenko, G. I. Ind. Lab. (USSR) (Engl. Transl.); 38: No. 7, 1010-1016(Jul 1972).

Translated from Zavod. Lab.; 38: No. 7, 796-800(Jul 1972).

A survey of studies on the determination of yttrium published from 1964 through 1971 is presented. Precipitation, gravimetric, titrimetric, spectrophotometric, and spectrochemical methods are included as well as solvent extraction and chromatographic methods of separation. (67 references) (DHM)

27329 INVESTIGATION OF THE CONDITIONS OF THE PHOTOMETRIC DETERMINATION OF MOLYBDENUM WITH THE REAGENT SULFONITRAZO. Dedkov, Yu. M.; Rybina, T. F.; Yakovlev, P. Ya. (Scientific Research Inst. of Ferrous Metallurgy, Moscow). Ind. Lab. (USSR) (Engl. Transl.); 38: No. 7, 1000-1002(Jul 1972).

Translated from Zavod. Lab.; 38: No. 7, 787-790(Jul 1972).

Molybdenum reacts with sulfonitrazo in sulfuric acid, hydrochloric acid and nitric acid solutions. The color of the complex compound is developed immediately after the addition of the reagent, and its intensity is unchanged for 24 h. The maximum yield of the complex compound is achieved at pH 1 to 3. A photometric method for determining molybdenum in steels and alloys based on Fe and containing Cr, Ni, and Co is described. The effect of various compounds, anions, and cations on the determination was studied. (DHM)

27330 PHOTOMETRIC DETERMINATION OF CERIUM WITH BERYLLON II. Bagbanly, I. L.; Rustamov, N. Kh. (Inst. of Inorganic and Physical Chemistry, Baku). Azerb. Khim. Zh.; No. 2, 163-166(1972). (In Russian).

Beryllon II (8-hydroxynaphthalene-3,6-disulfonic acid (1-azo-2')-1'-8'-dihydroxynaphthalene-3',6'-disulfonic acid, tetrasodium salt) has previously been utilized in analytical determinations, particularly of Be and B. Beryllon II forms a blue compound with Ce in a ratio of 1:1, which may be determined spectrophotometrically at 610 nm (the reagent having a maximum light absorption at 555 nm). The method is applicable to the determination of from 10 to 1200 μg Ce/50 ml. The following ions were shown to interfere: Hg(II), Te(IV), Se(IV), In(III), Zn^{2+}, Pb^{2+}, Fe(II,III), AsO_3^{3-}, PO_4^{3-}, BO_3^{3-}, and Complexon. (KSW)

27331 CHEMICAL-SPECTROGRAPHIC METHOD FOR THE ANALYSIS OF HIGH-PURITY THALLIUM INVOLVING DISTILLATION OF THE BASE. Chalkov, N. Ya.; Yudelevich, I. G.; Ustimov, A. M. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 5, 161-166(Sep 1972). (In Russian).

The concentrating of microimpurities in high-purity thallium by distilling the base in the form of volatile compounds of univalent nitrate and chloride of thallium in vacuum with heating was studied. A radiochemical method indicated that Bi, Cd, Fe, Ni, Co, and Ca, concentrate up to 80 to 100% and Cu, Ag, Pb, As, Zn, and In up to 10 to 45%. The interaction between thallium and cadmium chloride was used to partially chloride the thallium. Ag, Au, As, Bi, Cu, Co, Fe, Ga, In, Ni, Sb, Sn, Pb, Te concentrate in the thallium melt. Reaction products such as thallium chloride and metallic cadmium are distilled off. A chemical-spectrographic method for the analysis of high-purity thallium for Al, Ag, As, Bi, Ca, Cd, Co, Cu, Fe, Ga, In, Sb, Sn, Pb, and Te with a sensitivity of 1×10^{-5} to 5×10^{-7}% is suggested. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 27653, 27657, 27687, 27688, 28077, 28078, 28090–28092, 29403, and 29771.

27332 FILTER PAPER ANALYSIS BY FLUORESCENCE MEASUREMENTS. Bodart, F. (Univ., Namur, Belg.); Deconninck, G.; Hontoy, J.; Wilk, S. Radiochem. Radioanal. Lett.; 13: No. 3, 161-167(3 Apr 1973).

A method to analyze loaded filter paper used in air pollution control is described. More than 10 elements were identified and analyzed quantitatively in the submicrogram region. Using a low energy Van de Graaff accelerator, the filters were bombarded with 1.7 MeV protons, and the fluorescence x-rays were detected in Si(Li) and Ge(Li) detectors. The main characteristics of the method are speed and accuracy. It is possible to analyze 5 filters in one hour. (auth)

27333 RADIO-RELEASE DETERMINATION OF HYDROGEN FLUORIDE IN AIR USING RADIOACTIVE KRYPTONATE OF SILICA. Jesenak, V.; Naoum, M. M.; Tolgyessy, J. (Slovak Technical Univ., Bratislava). Radiochem. Radioanal. Lett.; 13: No. 3, 199-205(3 Apr 1973).

Radioactive kryptonate of silica is suggested for the determination of hydrogen fluoride concentration in air. Kryptonated discs of silica were allowed to react with different concentrations of HF in air and the results were found to be linear within the 2 to 10 ppM concentration range, and in fair agreement with theoretical assumptions. (auth)

27334 ADVANCES IN X-RAY ANALYSIS. Volume 15. Proceedings of the Twentieth Annual Conference on Applications of X-ray Analysis Held at Denver, Colorado, August 11–13, 1971. Heinrich, K. F. J.; Barrett, C. S.; Newkirk, J. B.; Ruud, C. O. (eds.). New York; Plenum Publishing Corporation (1972). 582p. (CONF-710802–). $25.00.

From 20th Annual Conference on Applications of X-Ray Analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

The current development of x-ray technique in analytical chemistry is examined critically. Forty-five papers are included. Separate abstracts were prepared for eleven. (MHR)

For abstracts of individual papers see: 27335–27337, 27639, 27640, 27687–27689, 29358, 29359, and 29371.

27335 RAPID QUANTITATIVE ANALYSIS BY X-RAY SPECTROMETRY. Giauque, R. D.; Jaklevic, J. M. (Univ. of California, Berkeley). Advan. X-Ray Anal.; 15: 164-175(1972).

From 20th Annual Conference on Applications of X-Ray Analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802–.

An x-ray fluorescence analysis method applicable to the case of fluorescent spectra excited with monoenergetic x-rays was developed. The technique employs a minimum number of calibration steps using single element thin film standards and depends upon theoretical cross sections and fluorescent yield data to interpolate from element to element. The samples are treated as thin films and corrections for absorption effects are easily determined. Enhancement effects, if not negligible, are minimized by sample dilution techniques or by selective excitation. (auth)

27336 DETERMINATION OF ZIRCONIUM, HAFNIUM, NIOBIUM, TANTALUM, MOLYBDENUM, AND TUNGSTEN IN AQUEOUS SOLUTIONS BY RADIOISOTOPIC EXCITED X-RAY FLUORESCENCE. Chan, F. L. (Aerospace Research Labs., Wright Patterson AFB, OH); Jones, W. B. Advan. X-Ray Anal.; 15: 209-227(1972).

From 20th Annual Conference on Applications of X-Ray Analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802-.

A radioisotopic excited x-ray fluorescence method for determining Zr, Hf, Nb, Ta, Mo, and W in aqueous solutions is presented using ^{125}I as source. (DHM)

27337 PROTON-INDUCED X-RAY EMISSION SPECTROSCOPY IN ELEMENTAL TRACE ANALYSIS. Johansson, T. B.; Akselsson, R.; Johansson, S. A. E. (Lund Inst. of Tech., Sweden). Advan. X-Ray Anal.; 15: 373-387(1972).

From 20th Annual Conference on Applications of X-Ray Analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802-.

Using protons in the MeV range as excitation source and a high resolution Si(Li) detector, x-ray emission spectroscopy is shown to be capable of analyzing many elements with Z > 15 simultaneously at the 10^{-12} g level. A theoretical lower limit of detection at moderate proton energies is discussed. Examples of possible applications are: analysis of the elemental composition of air-borne particles as a function of particle size, oil slick identification, and analysis of water and blood serum. (auth)

27338 AUTOMATIC MEASUREMENT AND CALCULATION SYSTEM FOR ROUTINE MEASUREMENT OF GAMMA SAMPLES. ten Haaf, F. E., (Philips Administration Lab. for Nuclear Radiation Gauges, Eindoven, Netherlands). Nucl. -Med., Suppl.; No. 9 Suppl., 114-115(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

An automatic sample changer was developed for routine measurements of large sample series with various gamma emitters and different measuring conditions. The sample changer was loaded with exchangeable containers, each holding 18 samples. On the front side of each container was a plastic strip with a binary code indicating the sample number and the measuring program. With this procedure, sample series from 12 different experiments could be measured concurrently without monitoring. (HBG)

27339 SIMULTANEOUS DETERMINATION OF ^{210}Pb AND ^{210}Po IN SEA WATER. Nozaki, Y.; Tsunogai, S. (Hokkaido Univ., Japan). Anal. Chim. Acta; 64: No. 2, 209-216(Apr 1973).

A radiochemical procedure is described for the determination of lead-210 and polonium-210 in seawater. These nuclides are concentrated by coprecipitation with calcium carbonate from a seawater sample of large volume and then separated from calcium by formation of the hydroxides. Polonium-210 is deposited spontaneously onto a silver disc and determined by an α-counting technique. Lead-210 is also determined by counting the activity of polonium-210 produced during storage for 3 months. (auth)

27340 ANALYSIS OF COMPOUNDS OF LIGHT ELEMENTS WITH THE USE OF ELASTIC SCATTERING OF CHARGED PARTICLES. Habanec, J. (Nuclear Research Inst., Rez., Czech.). Radioisotopy; 13: No. 5, 957-976(1972). (In Czech).

The analysis of complex substances by means of elastic scattering of charged particles on thin and thick targets is described for alpha particles. The sensitivity and precision of the method including spectra processing is reported. (auth)

27341 ESTIMATION OF THE RELATIVE CONCENTRATION OF SHORT-LIVED RADON DAUGHTERS BY GAMMA MEASUREMENTS. Rangarajan, C.; Gopalakrishnan, S. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 24: No. 4, 433-436 (Apr 1973).

A method is described for the estimation of the disequilibrium of radon daughters in which the decay of RaC activity only is followed by gamma counting. It was found theoretically by study of the decay curves as a function of disequilibrium that maximum sensitivity is obtained by short collection times as the existing disequilibrium of the air is not disturbed on the filter by the collection process. Using NaI crystals large area filters through which large volumes of air have been sucked for short periods can be counted selectively for RaC, and its decay followed. From these curves the extent of disequilibrium can be estimated. The advantage of the method is that the decay curve can be measured after collecting a sample for a few minutes only in free air and thus the state of equilibrium of short-lived radon daughters can be estimated in the open atmosphere with improved accuracy. (UK)

27342 APPARATUS FOR THE DETERMINATION OF PAPER AND THIN LAYER CHROMATOGRAMS OF SUBSTANCES LABELLED WITH ^{14}C. Peisker, K.; Fingas, H. (Martin-Luther Univ., Halle, Ger.). Isotopenpraxis; 8: No. 11-12, 462-446(1972). (In German).

An apparatus is described for the determination of radioactive zones (^{14}C-labelled substances) at paper- and thin-layer chromatograms. (auth)

27343 INDIRECT DETERMINATION OF ^{235}U BY α-SPECTROMETRY. Rao, B. L.; Parekh, P. P.; Reddy, G. R.; Sankar Das, M. (Bhabha Atomic Research Centre, Trombay, India). Anal. Chim. Acta; 64: No. 2, 296-299(Apr 1973).

Theoretical studies indicate that at low enrichment values a linear relationship exists between U-234 and U-235 content, which can be determined by measurement of U-234 α activity. A method is described that consists of electrodeposition of uranium, measurement of the α activity of U-234, and computation of the U-235 content by means of a calibration curve. Analytical results for two uranium samples of unknown enrichments compare fairly well with values obtained by other methods. The procedure is particularly suitable for the determination of U-235 in process wastes. (JGB)

27344 PROTON-EXCITED CHARACTERISTIC X-RAY EMISSION: A NEW METHOD FOR TRACE ANALYSIS. Akselsson, R.; Johansson, T. B.; Johansson, S. A. E. (Tekniska Hoegskolan, Lund, Sweden). Nord. Hyg. Tidskr.; 53: No. 1, 11-20(1972). (In Swedish).

The combination of proton excitation and Si(Li)-detectors offers a sensitive method for multi-element trace analysis. Best results are obtained if the samples are prepared as thin targets, i.e., thicknesses in the order of mg/cm^2. The application of the method was tested in the analysis of air-borne particulates collected with a cascade impactor, water samples, blood serum, and freeze-cut slices of tissues. The mass of some elements in air-borne particles as a function of their size is tabulated. Elements determined in a water sample and impurities in the backing carbon foil are also tabulated. (auth)

27345 DETERMINATION OF CHROMIUM IN ORES BY A RADIOISOTOPIC X-RAY FLUORESCENCE METHOD WITH A ^{147}Pm SOURCE AND AN INTERMEDIATE TARGET. Bochenin, V. I.; Vasyuk, F. M.; Sokolov, O. N. (Karaganda Polytechnic Inst., USSR). Ind. Lab. (USSR) (Engl. Transl.); 38: No. 6, 880 (Jun 1972).

Translated from Zavod. Lab.; 38: No. 6, 690-691(Jun 1972).

An x-ray fluorescence method for determining chromium in ores was developed using a $^{147}Pm(NO_3)_3$-CdO isotopic x-ray source. The time taken for analysis of a single sample was 3 to 4 min. The relative error of deviation did not exceed +3.3 to -3.7%. (DHM)

Separation Procedures

Refer also to abstracts 27360 and 27451.

27346 (NIIAR-P-116) STUDYING THE KINETICS OF TBP EXTRACTION OF URANIUM, PLUTONIUM, RUTHENIUM, AND ZIRCONIUM WHILE MIXING THE SOLUTIONS IN THE CENTRIFUGAL FIELD. Pushlenkov, M. F.; Yakovlev, G. N.; Kuznetsov, G. I.; Shchepetil'nikov, N. N.; Kasimov, F. D. (Scientific Research Atomic Reactor Inst., Melekess (USSR)). 1971. 18p. (In Russian). INIS.

A method was developed for studying the kinetics of extraction processes. The extraction of U and Pu proceeded more rapidly than Zr and Ru, the mass transfers of which was fixed by the rates of slow chemical transformations. It was possible to increase the distribution coefficients in isolated cases by utilizing the difference in their extraction rates. (tr-auth)

27347 RETENTION OF SOME TRANSITION ELEMENTS ON TIN DIOXIDE IN WATER-ACETONE, HNO_3-ACETONE, AND HCl-ACETONE MEDIA. Renault, N.; Deschamps, N. (CEN de Saclay, Gif-sur-Yvette, France). Radiochem. Radioanal. Lett.; 13: No. 3, 207-215(3 Apr 1973). (In French).

Results of a study on retention of some transition elements (Mo, W, Re, Pd, Tc, Ag, Pt, Au) on tin dioxide, in water-acetone, 0.1N HNO_3-acetone, and 0.1N HCl-acetone media are reported. Effects of acetone concentration were studied. Results of chemical separations in these media and the effects of acetone on ion-exchange properties of SnO_2 are given. (auth)

27348 LIQUID-LIQUID DISTRIBUTION (SOLVENT EXTRACTION). Stary, J. (Technical Univ., Prague). pp 279-307 of Physical Chemistry, Series One. Volume 12. Analytical Chemistry. Part 1. West, T. S. (ed.). Baltimore; University Park Press (1973).

The theory of liquid-liquid distribution (solvent extraction) is discussed and its application in elemental analysis is reviewed. 198 references. (ERB)

27349 SELECTIVE FLOTATION OF INORGANIC IONS. Charewicz, W.; Walkowiak, W. (Technical Univ., Wroclaw). Separ. Sci.; 7: No. 6, 631-646(1972).

On the basis of both the literature data and the results of current studies, some chemical and physicochemical aspects of selective flotation of inorganic ions are discussed. Classification of properties and events that determine the flotated ion separation, such as ionic charge, base–acid equilibria, complexation processes, solubility of ion-collector compounds, and ion affinity to surfactants are described and exemplified. (auth)

27350 RADIOCHEMICAL SEPARATIONS BY ADSORPTION ON CADMIUM METAL LOADED CHROMATOGRAPHIC COLUMNS. Ganzerli Valentini, M. T.; Maxia, M. T.; Meloni, S.; Rollier, M. A. (Univ., Pavia, Italy). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 115-119(Feb 1973).

The adsorption properties of cadmium metal are investigated. The behavior of 48 elements has been studied by column experiments from nitric and sulfuric solutions. The amounts of cadmium released under different adsorption conditions and the pH of the solutions are reported. A number of elements are adsorbed from nitric solutions and some of them can be removed by washing with sulfuric acid; only noble metals, copper, selenium and mercury are strongly adsorbed under all the investigated conditions. Different mechanisms are suggested to explain the behavior of adsorbed elements, redox processes, precipitation of hydrolyzed species, and precipitation of low solubility cadmium salts. Some applications to radiochemical separations have also been carried out. Noble metals have been separated from nickel, manganese, cobalt and zinc; cobalt and zinc were separated from neutron irradiated iron matrix; neptunium(VI) was separated from an uranium sample; finally selenium was separated from an irradiated biological matrix. (auth)

27351 CHROMATOGRAPHIC SEPARATION OF SOME METALS IN THE GASEOUS PHASE. Gasco, L.; Risby, T. H. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 16: No. 78, 421-438(1972). (In Spanish).

After a general consideration of the chromatographic separation of various volatile metallic compounds in the gaseous phase (such as hydrides, halides, carbonyls, and organometallic compounds), it is concluded that the most appropriate are the metallic chelates, especially β-dicetonates. The most important prerequisites are stability and ease of preparation. The methods of preparation of the chelates are discussed and their chemical properties are examined. An extensive study is made of their extraction with solvents as a separation and concentration step before gas chromatography. A brief review is made of the coordination chemistry of the metallic chelates, of the properties of their physico-chemical constants, and their molecular structure. The application of chromatographic separation of chelates in the analysis of biological materials, in the analysis of nuclear and metallurgical materials, in space studies, in the preparation of pure chelates, and in the determination of physico-chemical constants and reaction kinetics is discussed. It is shown that in many cases gas chromatography is superior to that of other analytical techniques having limits of detection of up to 10^{-13} g. (tr-auth)

27352 ANION EXCHANGE OF SOME ELEMENTS IN ACETIC ACID-HYDROCHLORIC ACID MEDIUM. De Corte, F.; Van Acker, P.; Hoste, J. (Univ., Ghent). Anal. Chim Acta; 64: No. 2, 177-185(Apr 1973).

A comparative study of the adsorbability of Cd(II), Ni(II), Mn(II), Ga(III), La(III), Mo(VI), and bromide from aqueous acetic acid solutions on Dowex 1-X8, 100 to 200 mesh, in the acetate and chloride forms, proved that chloride ions are indispensable for high adsorption from concentrated acetic acid solutions. A study of the adsorption isotherms of Ni(II), Mn(II), and Cd(II) on the acetate-form resin from acetic acid–hydrochloric acid solutions, showed that these elements form anionic complexes. The K_d values on RCl-exchanger, for a given acetic acid concentration, were highly dependent on the total exchange capacity of the resin. A simplified anion-exchange separation procedure in aqueous acetic acid was developed, with an adsorption step from a mixture of acetic and hydrochloric acids. (auth)

27353 CHROMATOGRAPHIC BEHAVIOR OF 47 METAL IONS ON TITANIUM(IV) ARSENATE PAPERS. Qureshi, M.; Rawat, J. P.; Sharma, V. (Aligarh Muslim Univ., India). Talanta; 20: No. 3, 267-277(Mar 1973).

Titanium arsenate papers with As/Ti ratios 0.2 to 2.2 were prepared and 47 metal ions chromatographed on these papers in 10^{-3} to 4M nitric acid. The effect of pH and of the Ti/As ratio on the R_f values was studied. A new quantity R_i ($R_i = R_f$ on untreated papers minus R_f on treated papers) was defined. Effects of the concentration of the loading reagents on the Ti/As ratio of the ion-exchanger precipitated on the papers were determined. Contrary to Alberti, it is shown that Lederer's equation is obeyed by titanium arsenate papers in the sodium form if the activity of Na^+ ions is considered instead of their concentration. It was also demonstrated that the selectivity sequence for cations on titanium arsenate papers is not the same as that on titanium arsenate columns. (auth)

27354 QUATERNARY SYSTEM $CeCl_3$–$EuCl_3$–$LaCl_3$–H_2O AT 25°C. Nikolaev, A. V.; Sorokina, A. A.; Yudina, N. G.; Lubkova, V. N. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 5, 35-40(Sep 1972). (In Russian).

The isotherm of the quaternary system $CeCl_3$–$LaCl_3$–$EuCl_3$–H_2O was studied. The position of double-saturation line was proved by 8 motions of 18 points of liquid-phase compositions. The field of solid solutions $CeCl_3$ + $EuCl_3$ (with some content of $LaCl_3$) was determined by 7 points from 3 motions. Small surface of the field is connected with the IVc type. The presence of a succession of solid solutions (La, Ce)$Cl_3 \cdot 7H_2O$ with some content of $EuCl_3$ was determined using many points of the solid-phase compositions. Some observations of the separation inside the system are made. The cost of $CeCl_3 \cdot 7H_2O$ and $LaCl_3 \cdot 7H_2O$ is so small when compared that that of $EuCl_3 \cdot 6H_2O$ that it is economically advantageous to utilize them to salt out the Eu salt. Purification by extraction of sorption of a salt of 80 to 95% purity requires only a minimal effort and extraction/sorption agent. (KSW)

27355 PROCESS FOR CONCENTRATION OF NIOBIUM MINERALS BY FLOTATION USING FOAM. (to Molybdenum Corp.). Belgian Patent 749,551. 24 Apr 1970.

A process for the concentration of an oxide mineral of niobium and of tantalum by flotation is characterized by the fact that there is incorporated in the pulp an organic amine collector chosen from among amines of high molecular weight and their water-soluble salts, a water-soluble salt, or a water-soluble acid containing the fluoride ion and a wetting agent. The aeration and flotation are carried out in an aqueous pulp having a pH less than 7.0. (BE)

27356 STUDY OF THE BEHAVIOR OF SOME RADIOISOTOPES WITH FERRIC OXIDE. Guillaume, M. (Univ., Liege). Analusis; 1: No. 7, 467-474(Dec 1972). (In French).

The retention properties of powdered $Fe_2O_3.nH_2O$ particles of uniform granulometry (0.1 to 0.5mm) with respect to 30 different radioisotopes were studied. The studies were carried out in a 0.1N HNO_3 medium at room temperature. The distribution coefficients were measured together with the maximum retention capacities. The results demonstrate that the cations do not have any affinities; the mixed elements formed in oxygenated anion solutions are adsorbed, the retention being proportional to the acid characteristics of the element; halogens are fixed with a capacity of the order of 0.2 meq/g. The separation of the ions of an element at different degrees of oxydation is possible if the ions exhibit different acid-base characteristics, e.g., Cr and Mn in the following valence states; +III, +VI, +II, +VII. Studies of the adsorption properties of certain anions in a column previously saturated with the same anions indicated that in most cases no isotopic or ionic exchange mechanisms occur. The formation of insoluble compounds with the inorganic adsorbent is hypothesized. (France)

27357 ABSORPTION OF MOLECULAR IODINE BY A SILVER-PLATED NET. Guerrini, B.; Lanza, S.; Mazzini, M.; Mirandola, R. Ing. Nucl.; 13: No. 1, 30-34(1972). (In Italian).

The absorbing capacity of a silver-plated reticule for vapors of molecular iodine at temperatures of 75°C and at relative humidities up to 100% was studied. The retention of the I_2 by Ag over a range of velocities of the moving gas carrying the I_2 from 1 to 250 cm/sec, with a variable I_2 concentration (0.3 to 30 μg/l), indicated that removal of over 99% of the I_2 was possible. (KSW)

27358 EXTRACTION OF METALS BY α,α-DIALKYLMONOCARBOXYLIC ACIDS. Nikolaev, A. V.; Khol'kin, A. I.; Gindin, L. M.; Freidlina, R. Kh.; Luboshnikov, K. S.; Kuznetsova; L. M.; Terent'ev, A. B. Izv. Sib. Otd. Akad. Nauk SSSR, No. 12, Ser. Khim. Nauk; No. 5, 52-58(Sep 1972). (In Russian).

The extraction of 20 cations by a 2M solution of α,α-dialkylmonocarboxylic acid (VIK-1) in decane was studied. The extractability of studied metals decreases in the order Fe(III) > Al > In > Cu > Pb > Y > La > Cd > Zn > Ni > Co > Ca > Ba > Sr > Mg > Li > Na > K > Rb > Cs. Extractive properties of various monocarboxylic acids are compared. (auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstracts 28143, 28145, 28147, 28245, and 28277.

Chemical and Physicochemical Properties

Refer also to abstracts 28021 and 29378.

27359 (EUR-4955) HYDROGEN PRODUCTION FROM WATER USING NUCLEAR HEAT. Progress Report No. 2. (Annual Report Ending December 1971). (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). Apr 1973. 51p. Dep. NTIS (U. S. Sales Only) $4.75. EUR B.Fr. 70.-.

Multistep chemical processes for the decomposition of water, using nuclear heat, are studied in view of producing hydrogen as an intermediate energy vector. The results of the experimental work performed at the Ispra Establishment of the J.R.C. during the year 1971 are reported; the main object of the research is the Mark 1 cycle, the first patented of these chemical cycles. The studies are principally related to the chemical reactions (equilibria and kinetics studies), to the physical property measurements, to the corrosion problems, and to the preliminary flow-sheet determination. (auth)

27360 REACTOR SAFETY SPRAY SOLUTION BASE-BORATE. Soldano, B. A. (to United States Atomic Energy Commission). U. S. Patent 3,715,316. 6 Feb 1973. Filed date 28 Jan 1971. 6p.

A nuclear reactor safety spray solution was developed comprising an aqueous basic borate solution containing up to 1 vol % sodium thiosulfate and an effective quantity of a metal salt, which enhances the reaction rate of the solution with an organic iodide such as methyl iodide in contact with the solution, in comparison to the reaction rate between the iodide in contact with a solution that does not contain a rate-accelerating concentration of the salt. (Official Gazette)

Isotope Effects

27361 CALCULATION OF KINETIC ISOTOPE EFFECTS OF HYDROGEN TRANSFER REACTIONS IN SYSTEMS CONTAINING BENZOL DERIVATIVES RELATED TO THE TYPE OF SUBSTITUENTS. Johansen, H. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Berlin). Isotopenpraxis; 8: No. 11-12, 407-415(1972). (In German).

Ratios of rate constants k_H/k_D are calculated within the framework of Eyring's theory using the method of Johnston (BEBO) for hydrogen atom abstraction from ring-substituted cumenes by cumylperoxy radicals and from ring-substituted toluenes, ethylbenzenes, and cumenes by bromine atoms. In this order the ratio k_H/k_D is 4.76; 7.40; 6.75; 6.30 (T = 320°K) and for example for hydrogen atom abstraction from p-methyl, p-methoxy, p-nitro cumene by peroxy radicals the values of the ratios k_H/k_D are changed to 4.71; 4.51; 4.83. The method of Johnston fixing the bond order within the intermediate state is modified by a new ansatz for the determination of the exponents p and q (BEBO). For the determination of the structure of the intermediate complex the overlap integrals are taken into account, connected with the corresponding bonds. (auth)

27362 HYDRIDE ABSTRACTION FROM BENZOCYCLOPROPENE. Preliminary Communication. Mueller, P. (Univ., Geneva). Helv. Chim. Acta; 56: No. 1, 500-503(31 Jan 1973).

The reaction between benzocyclopropene and triphenylmethyl fluoroborate in acetonitrile shows an isotope effect K_H/K_D of 6.7. The isolation of the resulting triphenylmethane and benzaldehyde was effected. A mechanism for the formation of the latter is proposed, involving an intermediate benzocyclopropenium ion. (auth)

27363 DISSOCIATIVE ATTACHMENT TO H_2CO: FORMATION OF H^- AND D^- IN H_2CO, HDCO, D_2CO. Tronc, M.; Azria, R. (Paris Univ., Orsay, France). Compt. Rend., Ser. C; 275: No. 25, 1459-1462(18 Dec 1972). (In French).

Dissociative attachment to H_2CO was studied using a total ionization apparatus. Ionization curves were obtained together with the absolute value of the formation cross sections for the negative ions. The measurements made of the kinetic energy of the ions enabled the states of the fragments formed to be deduced. Isotopic effects involved in the formation of H^- and D^- ions in H_2CO, HDCO, and D_2CO were investigated using a mass spectrometer. (auth)

Isotope Exchange and Isotope Separation

27364 HYDROGEN EXCHANGE IN URACIL WITH HTO AND D_2O CATALYZED BY PLATINUM. Ido, T.; Tatara, M.; Kasida, Y. (National Inst. of Radiological Sciences, Chiba, Japan). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 81-86(Feb 1973).

The kinetics of hydrogen exchange at the 5- and 6-positions of uracil with HTO and D_2O catalyzed by Pt-black was investigated. A peculiarity which is characteristic of heterogenous reactions was observed, and the growth of the reaction interface was explained by the reorientation of the mono-labelled intermediate. A reaction mechanism based on an associative process was proposed, the mechanism was verified by a hydrogen-exchange experiment with 2,4-dimethoxypyrimidine, where only the 6-position was labelled. (auth)

27365 SEPARATION OF NUCLEAR ISOMERS OF ^{80}Br ON SOLID SURFACES. Dreyer, R.; Redlich, J. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Wiss. Z. Univ. Rostock, Math.-Naturwiss. Reihe; 18: No. 8, 945-949(1969). (In German).

Results of a study on the adsorption of ^{82}Br out of 10^{-4} molar NaBr-solutions on surfaces of zirconium, nickel, copper, gold, and platinum of different advanced treatment are described and discussed. The yields of ^{80g}Br are dependent on the condition of the surface of the respective metal and on the character of the binding between the adsorbed ^{80m}Br-ions and the metal. In an earlier communication it was shown that after adsorption of ^{80m}Br-ions at surfaces of zirconium and nickel and following desorption in water a separation of ^{80g}Br and ^{80m}Br takes place to a considerable percentage. A series of metals of different surface condition and oxydated surfaces were examined with respect to their properties for separating ^{80}Br isomers. Experiments were also carried out with poly(vinyl chloride) and quartz surfaces. (auth)

27366 GAS SEPARATION BY MEANS OF CIRCULATION DIFFUSION. Part 2. Separation of Stable Isotopes and Gas Mixtures by Means of Mass or Sweep Diffusion. Wolf, F.; Koenig, P.; Gross, M. (Martin-Luther Univ., Halle, Ger.). Isotopenpraxis; 8: No. 11-12, 416-422(1972). (In German).

A mass diffusion tube was designed to be used for separating $^{13}CH_4$ from methane of natural isotopic composition (1.06% of $^{13}CH_4$) with steam serving as propellant. The maximum separation factor was 1.13. Experimental results and literature setups were used to calculate a cascade providing the production of 1 g of $^{13}CH_4$ a day (purity being 90%). A second diffusion tube designed to the principle of sweep diffusion was used to perform experiments involving the separation of H_2 from N_2, or of H_2 from CH_4 alternatively. Calculation of a separation plant supplying 500 m^3 of hydrogen per hour (90%) out of a H_2-CH_4 mixture is discussed. Industrial use of the sweep diffusion method seems to be profitable with small quantities of gas and waste steam being available. (auth)

27367 PARAHYDROGEN CONVERSION AND HYDROGEN-DEUTERIUM EQUILIBRATION OVER CARBON SURFACES. Walker, P. L. Jr.; Ishikawa, Y.; Brown, D. E.; Austin, L. G. (Pennsylvania State Univ., University Park). pp 63-64 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Ortho-para conversion and $H_2/D_2/HD$ equilibration were studied on diamond and on Graphon burned out to various degrees. The influences of pressure, temperature, and poisoning by hydrogen, chlorine, and oxygen adsorption were studied. The results were consistent with very small fractions of the surface existing as sites active in paramagnetic or chemical mechanisms, where these were not equivalent to the sites active to low-temperature hydrogen adsorption. The kinetic forms indicated simple Langmuir adsorption-desorption kinetics with slow surface transitions of low activation energy. (auth)

27368 HYDROGEN ISOTOPE EXCHANGE IN 2-BUTANONE. Further Measurements and Some Comments. Cox, R. A.; Thorpe, J. W.; Warkentin, J. (McMaster Univ., Hamilton, Ont.). Can. J. Chem.; 50: No. 19, 3239-3241(1 Oct 1972).

The ratio of the rate constant for exchange at the methylene to that at the methyl position of butanone was found to be near 1.69 in 1:1 acetic acid-acetate buffer; nearly twice the value (0.86) for deuterioxide catalysis at 54.8°. Methods of obtaining rate constants for acetate catalysis from composite rates (acetate and deuterioxide), or from rates in buffer media, were found to be adequate for estimating rate ratios. Detailed temperature dependence of the relative rate constants for either system is not yet available but the effects are known to be small. For butanone enolizations the isokinetic temperature is in the neighborhood of 35°, when reaction is catalyzed by deuterioxide in aqueous media. (auth)

Feed Materials Processing

27369 (DOCKET-408102-7) HIGHLAND URANIUM MILL. Final Environmental Statement. (Directorate of Licensing (AEC), Washington, D. C.). Mar 1973. 120p. Dep. NTIS $8.00.

The impact of the facility, which uses an acid-leach, solvent extraction circuit for uranium ore processing is as follows: temporary reassignment of land use, extraction and recovery of ~32 million pounds of uranium concentrates, a change in local topography involving about 830 acres, removal of ~500 gallons/min of local ground water from the mine, stimulation of local economy, creation of a stabilized tailings pile, discharge of very small quantities of chemicals and radioactive materials to the environs, and a temporary adverse aesthetic impact from open-pit mining. Alternatives to the proposed action and summaries of comments received from federal, state, and local agencies, private organizations, and individuals are discussed. (MCG)

Radiation Chemistry

Refer also to abstracts 27813, 27815, and 27929.

27370 (AEC-tr-7415, pp 210-215) RADIOLYSIS OF CYTOSINE IN AQUEOUS SOLUTIONS. Khryakov, A. I. (Inst. of Biophysics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 792-795(1972).

The radiation chemical yields of the decomposition of the chromophore after γ irradiation of aqueous solutions of cytosine were determined. At concentrations of 10^{-4}-10^{-2} M, the yield is about 2.5 molecules/100 eV. In the region of concentrations 10^{-4} M the yield begins to decrease. In the case of irradiation of cytosine in solution at a concentration of 10^{-2} M in the presence of oxygen, one of the radiolysis products with an undamaged pyrimidine ring, uracil, is detected. The yield of uracil is an average of 0.03 molecules/100 eV. (tr-auth)

27371 (CEA-R-4384) ROLE OF INTRATRACK REACTIONS IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS BY RECOIL PARTICLES FROM $^{10}B(n,\alpha)^7Li$ REACTION. Sigli, P. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1973. 91p. (In French). Dep. NTIS (U. S. Sales Only). $6.75.

Thesis. Submitted to Paris Univ. (France).

Conditions for dosimetry in a nuclear reactor by a chemical process were studied. Experimental conditions for a water radiolysis study are given. Free radical and molecular product yields were determined. The high linear density of molecular products along the track suggests that hydrogen peroxide and hydrogen could react with radicals originating from the same track; they are intratrack reactions. Evidence of these reactions is proved and their yields determined. The origin of intratrack reactions is discussed in connection with the structure of the track. (auth)

27372 (COO-3478-10) THEORY OF REACTION KINETICS. Progress Report. Corbett, J. W.; Peak, D. (State Univ. of New York, Albany. Dept. of Physics). 15 Feb 1973. Contract AT (11-1)-3478. 6p. Dep. NTIS $3.00.

References to published results of theoretical studies on continuum reaction rate calculations, the molecular theory of nucleation, and discrete lattice calculations are given. (JGB)

27373 (INIS-mf-98) RADIATION CHEMICAL INVESTIGATIONS RESPECTING THE OXIDATION OF CYCLOHEXANE. Striefler, B. (Technische Universitaet, Hanover (West Germany)). May 1970. 94p. (In German). INIS.

Thesis.

The oxidation of cyclohexane as well as the decomposition of cumene-hydroperoxide in cyclohexane resulting from uv- and γ-radiation was studied in presence of oxygen or argon. Gas and thin layer chromatographic and titrimetric methods were used for the separation of reaction products and their analysis. The main products in cyclohexane oxidation are in all cases cyclohexanol, cyclohexanone, and cyclohexane-hydroperoxide which, however, differ in quantitative yields. The influence of uv- and γ-radiation on the decomposition of cumene-hydroperoxide in cyclohexane results in dimethylphenyl-carbinol as the main reaction product. The composition of the reaction mixture as a function of various parameters as well as a radical mechanism for the formation of products are discussed. (INIS)

27374 (JUL-897-PC) KINETIC INVESTIGATION OF CH, CH_3, C_2, AND CN_2 RADICALS PRODUCED BY PULSE RADIATION BY MEANS OF GAS PHASE ABSORPTION SPECTROSCOPY. Bosnali, M. W.; Perner, D. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie). Nov 1972. 114p. (In German). Dep. NTIS (U. S. Sales Only) $7.75.

The radiolysis of methane yielded the radicals CH_3, CH, and C_2. CH_3 and CH occurred predominantly, while C_2 played a minor role and could be detected only at low methane pressures of about 1 Torr. In pure methane, the major reaction is the reconstitution of methane, which, up to about 100 Torr, proceeded according to: $CH_3 + H \xrightarrow{M} CH_4$. The rate constants for the reactions of the CH radical with CH_4, C_3H_8, n-C_4H_{10}, C_2H_4, and C_2H_2 indicated collision yields from 0.1 to 0.3. For the reaction of CH with methane, probably forming ethylene and acetylene, the rate constant was 2×10^{10} liter/mol.sec. The dependency of the CH_3 yield on the methane pressure indicated a complex sequence of radiation-induced reactions. Irradiation of CO/N_2 mixtures produced the radical CNN. (HBG)

27375 (NYO-3753-22) NATURE OF OXYGEN-CONTAINING RADICALS IN RADIATION CHEMISTRY AND PHOTOCHEMISTRY OF AQUEOUS SOLUTIONS. ESR Evidence for Nb(V) and La(III)-Hydroperoxy Radicals. Technical Progress Report, September 1, 1971-July 1, 1972. Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1972. Contract AT(30-1)-3753. 9p. (COO-3221-22). Dep. NTIS $3.00.

Electron spin resonance spectral studies are reported which offer evidence for the existence of paramagnetic complexes of hydroperoxy radicals with Nb(V) or La(III). It is concluded that the complexed transients are generated via the one-electron oxidation of the peroxy metal complexes by $\dot{O}H$ and/or HO_2 radicals. (JGB)

27376 (ORO-4179-25) RADIOLYTIC INVESTIGATIONS OF MICELLAR SYSTEMS. Annual Progress Report. Fendler, J. H. (Texas Agricultural and Mechanical Univ., College Station. Dept. of Chemistry). 1973. Contract AT(40-1)-4179. .11p. Dep. NTIS $3.00.

27377 TEMPERATURE DEPENDENCE OF POTASSIUM CHROMATE RADIOLYSIS. Yang, M. H.; Wei, J. C.; Chuang, J. T.; Yeh, S. J.; Collins, C. H.; Collins, K. E. (National Tsing Hua Univ., Hsinchu, Taiwan). Radiochem. Radioanal. Lett.; 13: No. 3, 173-177(3 Apr 1973).

Temperature dependence of the γ radiolysis of ^{51}Cr-labeled potassium chromate was studied. The total radiolytic yield of $^{51}Cr(III)$ is low at -78°C, relatively high at 0°C and 17°C, and low again at 96°C both for the air-filled and evacuated samples. A possible explanation for these observations is given. (auth)

27378 SPECTRAL MEASUREMENTS OF THE GAMMA COUNT RATE IN A NEUTRON-IRRADIATED SALICYLATE-QUININE-LITHIUM COMBINATION. Szirmai, E.; Royl, P.; Wesser, U. (Univ., Stuttgart). Nucl. -Med., Suppl.; No. 9 Suppl., 1115-1118 (1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

In the Siemens school reactor SUR 100 BE, a combination of salycylate-quinine-lithium was activated. The gamma spectrum was determined at two different time periods following activation. In comparison with a gold probe, the chemical combination was less activated by a factor of 200. The gamma spectrum showed a distinct peak at 0.46 MeV. It decreased with a half-time of 70 min. and probably resulted from an element contained in the pelleting material. The chemical combination seemed to be well suited for application in clinical medicine because of the fact that it was not destroyed by radiation. (tr.-auth)

27379 EFFECTS OF CRYSTALLINE ENVIRONMENT ON PYRIMIDINE FREE-RADICAL FORMATION. Barbital Crystal Polymorphs and Sodium Barbital. Haak, R. A.; Benson, B. W. (Southern Illinois Univ., Carbondale). Int. J. Radiat. Biol.; 23: No. 2, 157-166(Feb 1973).

The effects of crystalline environment on x radiation-induced free radicals in a model system of pyrimidines (barbital I, II, IV, and sodium barbital) were investigated. The characteristics of the stable room-temperature radical were determined by ESR spectroscopy. Single-crystal studies were performed on barbital I and IV. The major free radical in all four species is formed by an ethyl abstraction from C_5. The unpaired spin density was 0.4 in all cases. A reorientation of the free radical in the crystal structure was observed in barbital I. An increase in radical yield was observed in sodium barbital (G = 0.41) as compared to barbital I and II (G = 0.17). Maximum radical concentrations were comparable in sodium barbital and barbital I and slightly lower in barbital II. These radical characteristics, together with the known crystal structures of the model system, indicate the relative importance of intermolecular crystalline environment parameters to solid-state free radical formation. (auth)

27380 ENDOR AND ESR STUDIES OF IRRADIATED CYTIDINE. Hampton, D. A. University, AL; Univ. of Alabama (1972). 88p. University Microfilms Order No. 73-8039.

Thesis (Ph. D.).

Single crystals of cytidine have been x-irradiated and studied by electron nuclear double double resonance, electron nuclear double resonance, and electron spin resonance techniques at room temperature. One radical specie was studied in detail and the results show anisotropic couplings of an unpaired electron to three hydrogen nuclei with the following principal values: $\alpha 1$, -66.3 MHz, -43.5 MHz, -20.7 MHz; $\alpha 2$, -68.9 MHz, -43.4 MHz, -20.3 MHz; $\alpha 3$, -37.2 MHz, -27.0 MHz, -13.6 MHz. The g tensor principal values are 2.0043, 2.0037, 2.0033. These data are consistent with a radical formed in the ribose sugar group as a result of x-ray ionization of either the $C_{4'}$-$C_{5'}$ bond for positive hyperfine principal values or ionization and breakage of the $C_{5'}$-$O_{5'}$ bond for negative hyperfine principal values. The experimental spin densities were 0.65 on $C_{5'}$ and 0.38 on $C_{4'}$. (Diss Abstr. Int., B)

27381 MODIFICATION OF CELLULOSE ACETATE REVERSE OSMOSIS MEMBRANES BY RADIATION GRAFTING. Bentvelzen, J. M.; Kimura-Yeh, F.; Hopfenberg, H. B.; Stannett, V. (North Carolina State Univ., Raleigh). J. Appl. Polym. Sci.; 17: No. 3, 809-820(Mar 1973).

Large excesses of a chain transfer agent, carbon tetrachloride, were introduced to a recipe for the mutual γ-radioinduced grafting of styrene to celluiose acetate film. The effects of the carbon tetrachloride on the molecular characteristics as well as the reverse osmosis and time dependent mechanical properties of resulting graft copolymers were determined. Extremely short side chains were generated as a consequence of the high concentrations of chain transfer agent and the composite results further suggest that the morphology of the grafted films is best described as destructured or internally plasticized consequent to grafting in the presence of CCl_4. Reverse osmosis fluxes increased with per cent graft; salt rejection was high and unaffected by per cent graft up to 40% graft; and the tensile creep under wet conditions was significantly retarded by the grafting. These effects were shown to accrue from grafting per se by control experiments involving α-methylstyrene, which will not propagate to form a polymer under these conditions. These results are compared and contrasted with earlier work on grafting in the absence of CCl_4 where long side chains of polystyrene were generated resulting in a structuring of the polymer involving domains of polystyrene-rich material and domains of cellulose acetate rich polymer. (auth)

27382 RADIATION-INDUCED POLYMERIZATION OF PERFLUOROBUTADIENE. Toy, M. S.; DiBari, J. C. (Stanford Research Inst., Menlo Park, CA). Ind. Eng. Chem., Prod. Res. Develop.; 11: No. 4, 404-406(1972).

A study is made of the radioinduced polymerization of perfluorobutadiene by use of gamma rays and high-energy electrons. The monomer undergoes 1,2- and 1,4-polymerizations to yield a solid polymer of molecular weight about 5000. Under the same total dose of radiation, 17.2 Mrad, the molecular weight and polymer yield increase with lower dose rate and longer polymerization period. The bulk and solution polymerizations in aprotic solvents, such as FC-43, FC-75, and n-C_8F_{18}, are compared under the same dose rate. The presence of solvents increases the yield and changes the relative proportions of 1,2- and 1,4-polymer units, depending upon the polarity of the aprotic solvents. A polar aprotic solvent, such as $(n\text{-}C_4F_9)_3N$ (FC-43), gives a lower yield and larger lower molecular-weight fraction, whereas the nonpolar solvents, such as n-C_8F_{18}, give a higher ratio of 1,4-polymerization. The content of 1,2-polymer units is higher in the lower molecular-weight fractions and in the presence of catalyst (5% CF_3OOCF_3). In the presence of this catalyst, the solvent effect on 1,2- and 1,4-polymerizations is less pronounced, and the polymer yield becomes higher in the polar solvent. The results are discussed. (auth)

27383 FORMATION OF BENZYL RADICALS BY PULSE RADIOLYSIS OF TOLUENE IN AQUEOUS SOLUTIONS. Christensen, H. C. (Aktiebolaget Atomenergi, Studsvik, Sweden); Sehested, K.; Hart, E. J. J. Phys. Chem.; 77: No. 8, 983-987(12 Apr 1973).

Benzyl radicals are formed by reaction of e^-_{aq} with benzyl compounds in aqueous solutions (benzyl chloride, bromide, thiocyanate, formate, and acetate). The observed spectrum of the benzyl radical is similar to the spectrum in organic solvents including the recently observed absorption band at 258 nm. The extinction coefficients at the maxima 258, 307, and 317.5 nm are 14,000, 3300, and 5500 M^{-1} cm^{-1}, respectively. OH reacts with toluene in aqueous solutions to form the hydroxymethylcyclohexadienyl radical, which in acid solutions eliminates H_2O to form the benzyl radical. The rate of this reaction is proportional to the proton concentration and the rate constant is $(1.11 \pm 0.04) \times 10^6$ M^{-1} sec^{-1}. In strongly alkaline solutions O^- reacts with toluene to form benzyl radicals by abstraction of an H atom from the side group with $k = (2.1 \pm 0.3) \times 10^9$ M^{-1} sec^{-1}. (auth)

27384 RADIATIVE PROCESSES OF THE SOLVATED ELECTRON IN POLAR FLUIDS. Kestner, N. R.; Jortner, J. (Tel-Aviv Univ., Israel). J. Phys. Chem.; 77: No. 8, 1040-1050(12 Apr 1973).

A theoretical study is presented of the physical properties of solvated electrons in ammonia based on the Copeland-Kestner-Jortner model, which incorporates short-range interactions via a first solvation layer and long-range interactions via polaron modes. Bound-bound and bound-continuum optical transition was studied emphasizing the problem of line shapes in absorption and emission. The total energy of the ground and excited states and its dependence on nuclear configurations was handled by three successive approximate calculations: (a) a temperature dependent potential including short-range radial displacements; (b) a temperature independent potential incorporating both radial and angular short-range displacements; (c) a multidimensional potential surface including both short-range and long-range (polaron) nuclear displacements. The calculated line shapes in absorption for a single solvent configuration include major contributions from short-range radial displacements and from the polaron modes. The energy and line shape for the $2p \rightarrow 1s$ emission band is predicted. A general formula is presented for photoionization cross section including the contribution of all medium modes and in this case the role of the polaron modes is crucial. (auth)

27385 ELECTRON-TRANSFER STUDIES OF NITROFURANS USING PULSE RADIOLYSIS. Greenstock, C. L.; Dunlop, I. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Int. J. Radiat. Biol.; 23: No. 2, 197-199(Feb 1973).

Pulse radiolysis studies were made of solutions (2×10^{-3} M) of nucleic acid bases, amino acids and other biochemicals, together with low concentrations of nifuroxime (2 to 20×10^{-5}M). The rate constants for the electron transfer reactions for the substrates used including sugars, amino acids, nucleic acids, phosphate esters and saturated acids were high, varying from $3.0 \times 10^9 M^{-1}$ sec^{-1} for glycine to $6.5 \times 10^9 M^{-1}$ sec^{-1} for orotic acid. The results were consistent with the trend of increasing electron transfer reactivity with increasing radiosensitizer electron affinity. Radiolysis of nitrous-oxide-saturated solutions containing 10^{-3}M substrate and 1 to 20×10^{-5}M nifuroxime, and studies in the absence of substrate indicated that the rate constants for the radical oxidation reactions were lower than the corresponding electron-transfer reactions, varying from $5 \times 10^8 M^{-1}$ sec^{-1} for glucose to $2 \times 10^9 M^{-1}$ sec^{-1} for adenine orotic acid and tyrosine. It is pointed out that of the substrates studied, the electron-adducts and free radicals of the nucleic-acid derivatives were the most rapidly oxidized by nifuroxime, suggesting the importance of DNA as a target for radiosensitized damage. (UK)

27386 RADIOCHEMICAL CONVERSION OF IODINE IN THE SYSTEM TRIBUTYL PHOSPHATE-HEXANE-H_2O-HNO_3. Zagorets, P. A.; Raskina, Z. I.; Bulgakova, G. P.; Makarov, V. M.; Sazhina, T. G.; Agafonova, T. N. At. Energ. (USSR); 34: No. 3, 205-207(Mar 1973). (In Russian).

The radiochemical behavior of iodine in TBP and in solutions of TBP-hexane was examined. The role of additives such as H_2O or HNO_3 in the radiolysis of these systems was explored. Gamma-irradiation of a solution of I_2 in dry TBP (2×10^{-2} M I_2) C_4H_9I was formed, together with a small amount of HI. The yield of C_4H_9I was significantly reduced by the presence of 5% H_2O, probably due to the protective action of hydrogen bonds. The quantity of C_4H_9I forming in the presence of HNO_3 was insignificant. The results are discussed, and mechanisms are suggested. (KSW)

27387 ESR SPECTRA OF RADICALS PRODUCED BY REDUCTION OF PYRIDINE AND PYRAZINE. Fessenden, R. W.; Neta, P. (Carnegie-Mellon Univ., Pittsburgh). Chem. Phys. Lett.; 18: No. 1, 14-17(1 Jan 1973).

Radicals produced by reaction of e^-_{aq} with pyridine, pyrazine, and pyrazinedicarboxylic acid were studied by electron spin resonance using the in situ radiolysis steady-state ESR technique. The radical anions initially produced were found to undergo rapid protonation on nitrogen to form pyridinyl and pyrazinyl radicals. The NH proton of pyridinyl radical does not dissociate even at pH 13.7. The radical from pyrazine was observed only in the doubly protonated positively charged form in acid and neutral solutions, but no spectrum was observed in alkaline media. With 2,3-pyrazinedicarboxylic acid the doubly protonated radical was observed at pH 4 to 8 and the singly protonated one at pH 11 to 12. The pK for this dissociation is 9.2. The hyperfine constants of the pyridinyl radical are compared with those obtained from INDO molecular orbital calculations. (auth)

27388 ESR STUDY OF CO^+ RADICALS ON A H-Y TYPE ZEOLITE. Vedrine, J. C.; Naccache, C. (CNRS, Villeubanne, France). Chem. Phys. Lett.; 18: No. 2, 190-194(15 Jan 1973).

γ irradiation at 77°K in the presence of 20 torr of ^{13}CO over well outgassed H-Y zeolite leads to a cation species identified with the

CO^+ radical. The ESR parameters are: $g_x \approx g_y = 2.0005$ and $g_z = 2.0045$, $c_x = 301$ Oe, $c_y = 255$ Oe and $c_z = 275$ Oe. The isotropic (277 Oe) and anisotropic (15.3 and 6.7 Oe) hyperfine splitting constants indicate that about 92.5% of the spin density is localized on a ^{13}C atom σ orbital. (auth)

27389 ELECTRON BEAM RADIATION CURING PROCESS FOR COATING FILM. Ishiwatari, J. (Nippon Electrocure Ltd., Tokyo). Kogyo Zairyo; 20: No. 9, 34-41(Sep 1972). (In Japanese).

Marked attention has been directed to the process for curing coating material by the irradiation of electron beam in modern painting industry. Acceleration voltage can be 300 kV, when distance between objects and irradiation window is 20 cm, film thickness is 10 to 300 microns, and density of the coating film is 0.9 to 2.0. In order to obtain rapid curing and small number of accelerator, current of the electron beam should be made strong. At present, 100 mA of the electron beam can be obtained. The electron beam accelerators comprise an electron gun for generating thermions, an accelerator tube for accelerating the electrons, a scanner for scanning uniformly a given width, a vacuum pump for keeping whole accelerating system in vacuo of 1×10^{-5} to 1×10^{-7} mmHg, and a window for taking the electron beam out of the system. Standard scanning velocity is 100 to 200 cycles/sec, though 5000 cycles is possible. Shielding material is a thin film of 20 to 40 microns made of aluminum or titanium. Coolant for the periphery of the window is water or inert gas such as nitrogen, or carbon dioxide gas. In addition, power supply, a conveyer, means for generating inert gas, shielding means and several instruments are equipped. EBC coating material is blended with unsaturated monomers, i.e., acrylic acid ester, methacrylic acid ester, etc., acting as thinner as well as cross-linking agent. The equipment of Sikkens Company for curing the coating of wooden doors, the equipment of National Coil Coaters Association for curing metallic coil coating of building materials, cans and articles, and the equipment of Ford Motor Company for curing the coating of automobile plastic parts are illustrated as the practical use of EBC. (Japan)

27390 PROCEEDINGS OF THE THIRD TIHANY SYMPOSIUM ON RADIATION CHEMISTRY. Volume II. Conference Held in Tihany, Hungary, May 10–15, 1971. Dobo, J.; Hedvig, P. (ed.). Budapest; Akademiai Kiado (1972). 373p. CONF-710517–Vol.2)).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971).

Separate entries were prepared for thirty of the thirty-one papers presented. An abstract of one paper appeared previously in NSA and can be located in the report number index under CONF-710517. (DHM)

For abstracts of individual papers see: 27283 and 27391–27419.

27391 CONDUCTIVITY STUDIES IN AQUEOUS SOLUTIONS. Hutton, A.; Schmidt, K. (CNR, Bologna). pp 1089-1094 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27392 PULSE RADIOLYSIS STUDIES OF HALOGENATED ORGANIC COMPOUNDS IN AQUEOUS SOLUTIONS. Koester, R.; Asmus, K. D. (Hahn-Meitner-Institut fuer Kernforschung GmbH, Berlin). pp 1095-1106 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27393 PROPERTIES OF SOLVATED ELECTRONS IN IRRADIATED METHYL ALCOHOL. Pikaev, A. K. (Inst. of Physical Chemistry, Moscow); Sibirskaya, G. K.; Kabakchi, S. A. pp 1107-1122 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27394 STOPPING, SCATTERING, AND PENETRATION OF LOW-ENERGY ELECTRONS IN WATER. Mozumder, A. (Univ. of Notre Dame, IN). pp 1123-1132 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27395 HEAVY ION RADIOLYSIS OF DILUTE AQUEOUS SOLUTIONS. Baverstock, K. F. (University of Nottingham, Eng.); Cundall, R. B.; Burns, W. G. pp 1133-1140 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27396 INFLUENCE OF THE NATURE OF ALKALINE METAL CATIONS ON H_2 YIELDS IN THE RADIOLYSIS OF NEUTRAL AND ACIDIC AQUEOUS SOLUTIONS. Byakov, V. M.; Nichiporov, F. G.; Bugaenko, L. T. pp 1141-1149 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27397 RADIOLYSIS OF ALKALINE ICE CONTAINING ADDITIVES. Kroh, J.; Stradowski, C. (Technical Univ., Lodz, Poland). pp 1173-1180 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27398 NATURE AND PROPERTIES OF THE RADICAL PRODUCTS IN LOW-TEMPERATURE RADIOLYSIS OF CARBOHYDRATES AND THEIR AQUEOUS SOLUTIONS IN THE GLASSY STATE. Makarov, I. E.; Ershov, B. G.; Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). pp 1181-1190 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27399 RADIOLYSIS BY PROTONS: DOSE-RATE AND LET EFFECTS. Pucheault, J.; Julien, R. (Centre de Recherches, Ivry, France). pp 1191-1199 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27400 TUNNEL EFFECT IN LOW-TEMPERATURE ELECTRON TRANSFER REACTION. Mikhailov, A. I.; Khairoutoinov, R. F.; Zamaraev, K. I.; Goldanskii, V. I. (Inst. of Chemical Physics, Moscow). pp 1201-1211 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27401 RADIOLYSIS OF WATER BY β RAYS OF TRITIUM: EFFECT OF HETEROGENEITY. Lamaire, G.; Ferradini, C. (Centre de Recherches, Ivry, France). pp 1213-1217 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27402 ELECTRON SOLVATION AND INTERACTION WITH ACCEPTORS IN PULSE RADIOLYSIS OF AQUEOUS HYDRAZINE SOLUTIONS. Slavinskaya, N. A.; Kozlov, B. M.; Pshezhezkii, S. Ya.; Shemarov, F. V.; Tshepel, L. V. (Inst. of Physical Chemistry, Moscow). pp 1219-1228 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27403 NATURE OF THE REACTIVE SPECIES IN THE PHOTOHYDRATION OF URACIL AND CYTOSINE DERIVATIVES. Burr, J. B. (Univ. of Oklahoma, Norman); Chan, A.; Park, E. H. pp 1229-1242 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27404 RADIOLYSIS OF AQUEOUS SOLUTIONS OF SOME SIMPLE COMPOUNDS CONTAINING ALDEHYDE GROUPS. I. Formaldehyde. Markovic, V.; Sehested, K. (Danish Atomic Energy Commission Research Establishment). pp 1243-1253 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27405 RADIOLYSIS OF AQUEOUS SOLUTIONS OF SOME SIMPLE COMPOUNDS CONTAINING ALDEHYDE GROUPS. II. Glyoxylic Acid. Sehested, K.; Markovic, V. (Danish Atomic Energy Commission Research Establishment). pp 1255-1267 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).

From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27406 RADIOLYSIS OF FORMIC ACID–OXYGEN SOLUTIONS AT pD 1.3 TO 13 AND THE YIELDS OF PRIMARY PRODUCTS IN THE γ RADIOLYSIS OF HEAVY WATER. Nenadovic, M. T.; Draganic, Z. D.; Draganic, I. G. (Boris Kidric Inst. of Nuclear Science, Belgrade). pp 1269-1280 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27407 RADIATION OXIDATION OF BIVALENT SULFUR IN AQUEOUS SOLUTIONS. Natroshvili, G. R.; Panchvidze, M. V.; Nanobashvili, H. M. (Inst. of Inorganic Chemistry and Electrochemistry, Tbilisi, USSR). pp 1281-1291 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27408 SOME QUESTIONS OF γ-RADIOLYSIS OF AQUEOUS SOLUTIONS OF THIOUREA. Gvilava, S. E.; Nanobashvili, H. M.; Ignatashvili, N. G. (Inst. of Inorganic Chemistry and Electrochemistry, Tbilisi, USSR). pp 1293-1299 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27409 MECHANISM OF RADIOLYSIS OF AQUEOUS METHANOL SOLUTIONS. Byakov, V. M.; Zhiltsova, L. V.; Kalyasin, E. P.; Kovalyova, E. P.; Petryaev, E. P. (Inst. of Experimental and Theoretical Physics, Moscow). pp 1301-1309 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27410 REDUCTION OF FERRICYTOCHROME C TO FERROCYTOCHROME C STUDIED BY PULSE RADIOLYSIS. Nilsson, K.; Pagsberg, P. (Danish Atomic Energy Commission Research Establishment, Risoe). pp 1311-1317 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27411 CORRELATION BETWEEN YIELD OF PRIMARY H_2O_2 IN WATER γ-RADIOLYSIS AND HALIDE ION REACTIVITIES (pH 0.5 TO 0.6). Kosanic, M. M.; Draganic, I. G. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). pp 1319-1332 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27412 RADIOLYSIS OF AQUEOUS SOLUTION OF PARATOLUENE SULPHONIC ACID. Makarotshkina, L. M.; Filippov, M. T.; Dzhagatspanyan, R. V. (Ministry of Chemical Industry, Moscow). pp 1333-1344 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest, Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27413 FORMATION AND CONVERSION OF RADICALS IN IRRADIATED SYSTEM BIOPOLYMER–WATER. Sharpatyi, V. A. (Inst. of Chemical Physics, Moscow). pp 1345-1352 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27414 RADIOLYSIS OF AQUEOUS SOLUTIONS OF SILVER SULPHATE. Haissinsky, M. (Laboratoire Curie, Paris). pp 1353-1365 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27415 RADIOLYSIS OF WATER AND AQUEOUS SOLUTIONS IN THE PRESENCE OF STABLE FREE RADICALS. Putirskaya, G. V.; Matus, I. (Central Research Inst. for Chemistry, Budapest). pp 1367-1380 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27416 RADIOLYSIS OF AQUEOUS SULPHURIC ACID SOLUTIONS OF ETHYLENE GLYCOL IN PRESENCE OF Fe^{2+} OR Fe^{3+} IONS AND OXYGEN. Kartasheva, L. I.; Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). pp 1381-1393 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27417 INVESTIGATION OF H_2O_2 ACCUMULATION IN IRRADIATED AQUEOUS KI SOLUTIONS. Botar, L.; Kroo, E.; Zsarnay, M. (Inst. of Nuclear Research, Warsaw). pp 1395-1403 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry, Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27418 RADIOLYSIS OF N_3^- IONS IN AQUEOUS SOLUTIONS. Kraljic, I. (Laboratoire de Physico-Chimie des Rayonnements, Orsay, France). pp 1405-1411 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol. 2).

27419 PROPERTIES OF THE POLYCRYSTALLINE AND GLASSY ALKALINE ICE IN THE VIEW OF TRAPPED ELECTRON MOBILIZATION BY LIGHT. Zagorski, Z. P.; Grodkowski, J. (Inst. of Nuclear Research, Warsaw). pp 1413-1420 of Proceedings of the Third Tihany Symposium on Radiation Chemistry. Vol. II. Dobo, J. (ed.). Budapest; Akademiai Kiado (1972).
From third symposium on radiation chemistry; Tihany, Hungary (10 May 1971). See CONF-710517–(Vol.2).

27420 PULSE RADIOLYSIS OF SOLUTIONS OF ALKALI METALS IN LIQUID AMINES. Fletcher, J. W.; Seddon, W. A.; Jevcak, J.; Sopchyshyn, F. C. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Chem. Phys. Lett.; 18: No. 4, 592-594(15 Feb 1973).
Pulse radiolysis of solutions of alkali metals in methylamine and ethylamine shows the formation of three distinct species; the solvated electron e_s^-, the alkali metal anion M^-, and a species considered to be a metal–electron pair with stoichiometry M. Hitherto no kinetic or conclusive optical evidence has been obtained for the species M in amine solutions. The three species coexist in equilibrium according to the equation $e_s^- + M^+ \rightleftharpoons M + e^- \rightleftharpoons M^-$ with the corresponding rate constants markedly dependent on the solvent and nature of the alkali metal. (auth)

27421 RADIATION DAMAGE MECHANISMS AS REVEALED THROUGH ELECTRON SPIN RESONANCE SPECTROSCOPY. Box, H. C. (Roswell Park Memorial Inst., Buffalo). Annu. Rev. Nucl. Sci.; 22: 355-382(1972).
The mechanisms involved in radiation damage that have been elucidated by ESR methods are reviewed. An attempt is made to identify, for example, the primary radiation-induced oxidation and reduction processes revealed by ESR studies in a variety of systems subjected to ionizing radiation. Primary mechanisms, secondary mechanisms, and overall mechanisms are considered as well as their relationships to radiation biology. (DHM)

27422 COMPETITIVE ELECTRON SCAVENGING EXPERIMENTS IN THE RADIOLYSIS OF HYDROCARBONS. Results at Low Solute Concentrations. Klein, G. W.; Schuler, R. H. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 77: No. 8, 978-983(12 Apr 1973).
The competitive effect of adding various second solutes (CH_2Br, CH_3I, C_2H_5Cl, C_2H_5Br, N_2O, SF_6, CCl_4, $(C_6H_5)_2$, c-C_4F_8 or c-C_6F_{12}) to 10^{-3} M solutions of methyl chloride in cyclohexane was examined in experiments designed to determine the reactivity of each of these solutes toward the electrons produced in the radiolysis of the solvent. It is shown that the dependence on the concentration of added solute is of the form expected from simple competitive considerations and that all data are superimposable by proper adjustment of the reactivity parameter α used in the empirical description of the concentration dependence for electron scavenging in single solute systems. Most of the values of α determined in this way are in the range 10 to 20 M^{-1} with the most efficient electron scavengers being CH_3I and c-C_6F_{12}. Values of this magnitude indicate that the electrons react in diffusion-controlled processes which are several orders of magnitude more rapid than for reactions involving molecular anions. A relatively slow rate is observed in the case of ethyl chloride where $\alpha(C_2H_5Cl) = 0.24\ M^{-1}$. A difference of a factor of 20 between the reactivities of methyl and ethyl chloride illustrates the very profound effect that can be made by a relatively small change in the molecule. Measurement of the parameter α by a competitive method, such as is done here, allows one to de-

scribe electron scavenging in systems where it is frequently not possible to make direct measurements readily. (auth)

27423 PULSE RADIOLYSIS STUDIES. XXII. Spectrum and Kinetics of the Sodium Cation-Electron Pair in Tetrahydrofuran Solutions. Bockrath, B.; Dorfman, L. M. (Ohio State Univ., Columbus). J. Phys. Chem.; 77: No. 8, 1002-1006(12 Apr 1973).

The optical absorption band of the sodium cation–electron pair, (Na^+e^-), in tetrahydrofuran solution was determined in pulse radiolysis studies. The absorption maximum is at 890 nm at 25°C, and shows a temperature coefficient of -7 cm^{-1} deg^{-1}. The molar extinction coefficient at the maximum is 2.4×10^4 M^{-1} cm^{-1}, and the oscillator strength is $f = 1.0$. The large shift from the maximum of the solvated electron in THF, which is at 2120 nm, suggests strong coupling with the cation. The absolute rate constant for the reaction of the solvated electron with free sodium cation is 7.9×10^{11} M^{-1} sec^{-1}, with an activation energy of 1.4 kcal/mol. Rate constants were also determined for several reactions of e_{sol}^- with organic molecules. For comparison rate constants for a number of reactions of (Na^+,e^-) were also determined. These were found to be roughly an order of magnitude lower than the rate constants for the analogous reactions of e_{sol}^-. The free-ion yield for e_{sol}^-, determined using sodium cation as scavenger, was found to be 0.39 molecule/100 eV. (auth)

27424 DISSOLUTION AND HYDROGEN PENETRABILITY OF ARMCO IRON IRRADIATED BY NEUTRONS. Balezin, S. A.; Spitsyn, V. I.; Laptev, N. Ya. (Moscow State Pedagogical Inst.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 15: No. 10, 1502-1505(1972). (In Russian).

Samples of Armco iron 0.8 mm thick were exposed to neutron fluxes of 1.2×10^{13} and 4.8×10^{13} $n/cm^2 \cdot sec$ for various periods of time, forming principally ^{55}Fe and ^{59}Fe. The dissolution rates of the irradiated samples in H_2SO_4 were, for the lower neutron flux, greater than those of the control samples; however, at the higher flux exposure, the irradiated samples initially dissolved faster, later more slowly, than the controls. When the dissolution tests were conducted in HCl, rates were identical at first, and then diverged. The amount of diffusion hydrogen in the Armco iron samples decreased during the higher dissolution rates, but increased with smaller dissolution rates. (KSW)

27425 MODIFICATION OF THE RADIATION EFFECT ON URACIL DERIVATIVES BY METAL IONS. Bruder, W.; Lohmann, W. (Technical Univ., Munich). Stud. Biophys.; 34: No. 3, 189-199(1972).

Aqueous solutions of uracil, thymine, uridine, 5-bromo-uracil, 5-iodo-uracil, 5-bromo-deoxy-uridine, and 5-iodo-deoxy-uridine, with and without addition of cupric ions, were irradiated with ^{60}Co γ rays. It could be shown spectrophotometrically that Cu^{2+} reduces the radiosensitivity of the halogenated derivatives only. The Cu^{2+} effect could not be observed when O_2 was bubbled through the solutions for 30 min. The effect was optimal, however, when the solutions were treated with N_2 and NaHCOO. From the results obtained, one might conclude that cupric ions act as radical scavengers, that is, they interact primarily with e_{aq}^- followed by an interaction of the cuprous ions with OH radicals. (auth)

27426 UNSTABLE INTERMEDIATES. Pt. 122. Electron Spin Resonance Studies of Radicals from Irradiated Trimethylphosphine oxide: the $Me_2\dot{P}O$ Radical. Begum, A.; Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc., Faraday Trans., II; 69: No. 1, 43-48(1973).

Exposure of trimethylphosphine oxide to γ-rays at 77°K gave, after slight annealing, ESR spectra with separate features assigned to $Me_2\dot{P}O^-$ (or $Me_2\dot{P}OR$), $Me_2\dot{P}O$, and $H_2\dot{C}PO(Me)_2$ radicals. At ~140°K the spectrum assigned to $Me_2\dot{P}O^-$ radicals was lost irreversibly, whilst that assigned to $Me_2\dot{P}O$ radicals changed reversibly to reveal well resolved proton hyperfine structure, with a(H) = 5.6 G. This temperature effect is explained in terms of extensive librations of the radicals, coupled with concerted restricted rotation of the methyl groups. In alcohol media, only $Me_2\dot{P}O$ or $Me_2\dot{P}OH$ radicals were detected, while in sulphuric acid the main phosphorus radicals were $Me_2\dot{P}^+$ and $H_2\dot{C}-P(OH)Me_2^+$. (auth)

27427 RADIOLYSIS OF HYDROCARBONS. XX. n-Alkanes in the Liquid Phase from Heptane to Dodecane. (Institut de Chimie Physique, Lausanne, Switzerland). Helv. Chim. Acta; 56: No. 1, 531-542(31 Jan 1973). (In French).

Effects of dose and temperature on the yields of the majority of the radiolysis products of the n-heptane, n-octane, n-nonane, n-decane, and n-dodecane were determined. The G-values of the products, excepting dimers are approximately the same for all the above n-alcanes. The temperature dependence, expressed as an apparent activation energy, is shown to be equal for all n-alkanes. (auth)

27428 PULSE RADIOLYSIS STUDY OF SULFHYDRYL COMPOUNDS IN AQUEOUS SOLUTION. Hoffman, M. Z.; Hayon, E. (Army Natick Labs., MA). J. Phys. Chem.; 77: No. 8, 990-996 (12 Apr 1973).

The interactions of hydrated electrons and hydroxyl radicals with a number of sulfhydryl compounds were studied using the technique of pulse radiolysis. Thioglycolic acid, β-mercaptopropionic acid, cysteamine, N-acetylcysteamine, cysteine, N-acetylcysteine, S-methylcysteine, penicillamine, glutathione, benzyl mercaptan, and thiodiacetic and thiodipropionic acids are among the compounds examined. The reaction rate constants of e_{aq}^- with these compounds were found to be strongly dependent on the acid-base properties of the sulfhydryl compounds, with the rate decreasing upon deprotonation of both the amino and the mercapto groups. The e_{aq}^- was shown to react with RSH to produce quantitatively the R· radical, $e_{aq}^- + RSH \rightarrow R\cdot + HS^-$. The reaction rate constants of OH radicals were found to be $\sim 1-3 \times 10^{10}$ M^{-1} sec^{-1} and essentially independent of the ionization constants of the sulfhydryl compounds. The OH radicals form the thiyl radicals, $OH + RSH \rightarrow RS\cdot + H_2O$. The absorption spectra, extinction coefficients, and decay kinetics of these thiyl radicals were determined for a number of RSH compounds. The rate constants of the reactions of RS· radicals with RSH and RS^- were measured, and the equilibrium constants for $RS\cdot + RS^- \rightleftharpoons RSSR^-$ were calculated for a few systems. The high electrophilicity of the thiyl radical is indicated. (auth)

27429 INTERACTION OF SOLVATED ELECTRONS WITH THE AMIDE AND IMIDE GROUPS. Acid-Base Properties of $RC(OH)NH_2$ Radicals. Simic, M.; Hayon, E. (Army Natick Labs., MA). J. Phys. Chem.; 77: No. 8, 996-1001(12 Apr 1973).

The technique of pulse radiolysis was used to study the interaction of solvated electrons with various amides and imides in aqueous solutions. The reactivity of e_{aq}^- with acetamide, malonamide, succinamide, oxamide, oxamate ion, biuret, diacetamide, succinimide, and N-methylsuccinimide was determined. It is found that the reactivity of the diamide oxamide is $k = 3.3 \times 10^{10}$ M^{-1} sec^{-1}, and that the rate decreases with the number of methylene groups in between the $-CONH_2$ groups. Thus $k = 1.1 \times 10^9$ M^{-1} sec^{-1} for malonamide and 2.0×10^8 M^{-1} sec^{-1} for succinamide. Insertion of an $-NH-$ group instead of a $-CH_2-$ group in between two amide groups, as in biuret, also decreases the reactivity toward e_{aq}^-. The rate of e_{aq}^- with the cyclic imide succinimide is almost diffusion controlled, $k = 1.1 \times 10^{10}$ M^{-1} sec^{-1}, and is the same as that of the corresponding open molecule diacetamide. The transient spectra, extinction coefficients, decay kinetics, and ionization constants of the radicals produced from the addition of e_{aq}^- to these amides and imides have been determined and correlated. Ionization constants ranging from 3.7, 8.4, and 9.8 to ≥13.5 for oxamide, succinimide, malonamide, and acetamide, respectively, were obtained. These and other results are discussed. (auth)

27430 FLUORESCENCE AND DELAYED EMISSION OF CHEMICAL SPECIES IN A γ-IRRADIATED NAPHTHALENE MONOCRYSTAL. Martin-Bouyer, J.; Martin-Bouyer, M. (Univ., Chambery, France). J. Chim. Phys.; 69: No. 11, 1679-1687(Nov 1972). (In French).

The presence of three new compounds was detected in an irradiated single crystal of naphthalene. Two are free radicals identified as naphthenyl, $C_{10}H_7$, and hydronaphthyl $C_{10}H_9$. In addition to the fluorescence spectra measured between 3907 and 6000 A, a delayed emission at 5225 A was recorded. This emission was attributed to the phosphorescence of the hydronaphthyl radical. The mechanism of formation of these radicals is considered; the different excited levels of the compounds (D_1, Q_1, S_1) are defined and the electronic transitions involved in the emissions are discussed. (France)

27431 EPR STUDY OF THE POST-RADIATION CHLORINATION OF POLYETHYLENE. Levitskii, M. B.; Roginskii, V. A.; Dzhagatspanyan, R. V.; Pshezhetskii, S. Ya. (Scientific-Research Physical-Chemical Inst., Moscow). Vysokomol. Soedin., Ser. B.; 15: No. 1, 45-48(Jan 1973). (In Russian).

The possibility was investigated of inducing chlorination by stabilized radicals arising from the γ-irradiation of polyethylene. Polyethylene powder was irradiated at 77°K (^{60}Co) and then chlorinated, followed by an EPR spectral study. The results indicated that radicals which had been stabilized during the γ-irradiation of polyethylene induced a chain reaction in chlorination. A decrease in the concentration of radicals (chain breaking) took place within limits. (KSW)

27432 RADIOLYSIS OF BENZENE + BROMOBENZENE SOLUTIONS. Kumar, S. S.; Merklin, J. F. (Kansas State Univ., Manhattan). J. Chem. Soc., Faraday Trans., I; 69: No. 3, 577-583(1973).

Yields from the γ radiolysis of benzene, bromobenzene, and solutions of benzene and bromobenzene were measured. The yield of biphenyl was larger in the solutions than in either of the pure solvents. Rate constants for quenching reactions were estimated on the basis of the measured product spectra and the published value of the ratio of rate constants for quenching in benzene–p-terphenyl–bromobenzene solutions. (auth)

27433 APPLICATION OF THE SMOLUCHOWSKI EQUATION TO ELECTRON SCAVENGING IN DIELECTRIC LIQUIDS. Numerical Evaluation of the Scavenging Probability for a Given Initial Separation of an Ion Pair. Infelta, P. P. (Carnegie-Mellon Univ., Pittsburgh). J. Chim. Phys.; 69: No. 10, 1526-1530(Oct 1972).

A numerical procedure for the evaluation of the probability for electron scavenging by a solute at a given concentration in the radiolysis of hydrocarbon solutions is developed. This procedure is based on the use of the Smoluchowski equation to describe the relative motion of the electrons and their positive ion partners. The results of these calculations for different initial ion-pair separation distances show that the observed concentration dependences of the scavenging probability are intimately related to the initial distribution of thermalization distances. It is shown that at a concentration of 10^{-1} M methyl bromide in cyclohexane, essentially no electrons separated from their positive ion partners by 80 A escape being scavenged. Experimentally it is observed that at this concentration only 50% of the electrons are scavenged so that an appreciable fraction of the ion pairs must be characterized by smaller separation distances. The selectivity of reaction is indicated by results at 0.01 M methyl bromide where scavenging occurs for 98% of the pairs initially separated by 160 A but only 15% where the separation distance is 40 A. (France)

27434 RADIATION POLYMERIZATION OF ACRYLONITRILE JOINTLY WITH VINYL SULFONIC DYES. Ryasnoi, V. D.; Arkhiptsev, V. M.; Salamatov, I. I.; Petryaev, E. P. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus, SSR, Ser. Fiz.-Energ. Navuk; No. 3, 37-41(1972). (In Russian).

A method for preparing dyed polyacrylonitrile by radiation-chemical polymerization of acrylonitrile in the presence of the dye-active yellow 2K is described. The yield, viscosity of colored polymer, and the quantity of the dye involved in the structure of the polymer are dependent on the irradiation dose, reaction temperature and pH. (auth)

27435 ACID DISSOCIATION CONSTANT OF THE CARBOXYL RADICAL. Pulse Radiolysis Studies of Aqueous Solutions of Formic Acid and Sodium Formate. Buxton, G. V.; Sellers, R. M. (Cookridge Hospital, Leeds, Eng.). J. Chem. Soc., Faraday Trans., I; 69: No. 3, 555-559(1973).

Pulse radiolysis of aqueous solutions of formic acid and formate ion in the pH range 0 to 13, using 2.9 MeV electrons, shows that the absorption spectrum of the carboxyl radical is constant between pH 2.5 and 13, but decreases in intensity between pH 2.5 and 0. It was also found that the effect of ionic strength on the rate of reaction of the radical with itself is the same at pH 2.7 and 7 and is consistent with the radical having unit negative charge at pH 2.7. The data presented indicate that the pK of the radical is 1.4. (auth)

27436 RADIOLYSIS OF UNDERGROUND WATERS AS A SOURCE OF HYDROGEN AND OXYGEN IN THE EARTH'S CRUST. Vovk, I. F. (Inst. of Geological Sciences, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. B: No. 1, 8-11(Jan 1973). (In Ukrainian).

On the basis of the experimental values of the hydrogen radiation-chemical yield in water radiolysis and of estimated values of absorbed doses of natural radioactive irradiations in main types of litosphere rocks the amount of hydrogen and the equivalent number of reactive compounds and free oxygen formed in water radiolysis in the earth's crust were determined. Total mass of hydrogen formed in such a way for 4×10^9 years amounts to 2.44×10^{15} and oxygen 19.52×10^{15} ton respectively. (auth)

27437 RADIOLYSIS OF AQUEOUS SOLUTIONS BY HIGH LET RADIATIONS. Oxidation of Fe(II) and Reduction of Ce(IV) in Sulfuric Solutions Irradiated with Low Energy Protons. Julien, R.; Pucheault, J. (CNRS, Ivry-sur-Seine, France). J. Chem. Phys.; 69: No. 10, 1561-1568(Oct 1972). (In French).

The radiolysis of various aqueous solutions (Fe(II), Ce(IV), Ce(IV)–Tl(I)) with low energy protons ($E \leq 350$ keV) was studied. The radical and molecular yields were determined and the results were compared with those obtained using other high LET radiations (helions, α rays, etc.). The important role played by the structure of the trajectories, particularly those due to secondary electrons and charge exchange phenomena, is emphasized. (France)

27438 ELECTRON SPIN RESONANCE FOR TRAPPED HYDROGEN ATOMS IN AQUEOUS MEDIA. Comments and Calculations on the Radicals H_3O^{2+} and H_3O. Claxton, T. A.; Ginns, I. S.; Godfrey, M. J.; Rao, K. V. S.; Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc., Faraday Trans., II; 69: No. 2, 217-223(1973).

Species with ESR spectra similar to those for gas-phase hydrogen atoms are readily obtained by photolysis or radiolysis of aqueous solutions at 77°K. It is suggested that these species are better described as highly distorted H_3O radicals, H_3O–H, with the unpaired electron in a δ orbital. This distortion may be intrinsic or forced on the system by the fact that the water molecule moiety is strongly hydrogen bonded to its neighbours. Ab initio Hartree–Fock calculations suggest that if symmetrical H_3O were formed, the proton hyperfine coupling would be ~210 G, which means that a 23 G quartet obtained by others in photolyzed aqueous solutions of cerium (IV) perchlorate was not due to H_3O. Calculations also showed that H_3O^{2+} could have been responsible for this quartet, but this is chemically improbable. Conditions could not be reproduced that are required for the formation of this 23 G quartet, and it was concluded that it was probably due to methyl radicals. The other major product detected by ESR in addition to "hydrogen atoms" in these photolyzed solutions was the hydroxyl radical, although in concentrated acid a triplet with $A(^1H)$ = 24 G was obtained which is tentatively assigned to H_3O^+ cations. (auth)

27439 ESR AND ENDOR STUDIES OF TRAPPED RADICALS IN γ IRRADIATED COMPOUNDS WITH HYDROGEN BONDS. Edlund, O. (Acta Universitatis Upsaliensis, No. 225. Uppsala; Uppsala Univ. (1972). 9p.

Thesis.

Electron spin resonance and ENDOR studies were made of radicals in different compounds after γ irradiation to different doses. All the compounds studied have a structure featuring pronounced hydrogen bonding. Publications included in the thesis are briefly described. (DHM)

Radiochemistry and Nuclear Chemistry

27440 RELEVANCE OF NUCLEAR ENERGY TO CHEMICAL INDUSTRY. Fratzscher, W. (Technische Hochschule fuer Chemie, Merseburg, Ger.). Kernenergie; 15: No. 9, 302-306 (Sep 1972). (In German).

There is a very close interrelation between demands of chemical industry for raw materials, raw material bound energy and raw material free energy. The relations between the different requirements characterize energy structure and may be influenced in comparatively wide limits. Insufficiency of raw materials or application of expensive raw materials will make the orientation to minimum consumption of materials rational if cheap nuclear energy is available. Development of chemical industry would, in particular, be revolutionized by production of high-temperature nuclear heat. Studies on this topic are a common task of chemical industry and energetics. (auth)

Hot-Atom Chemistry

Refer also to abstract 27371.

27441 (FRNC-R-18) CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. Bibliography 1971. Adolff, J. P. (Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Recherches Nucleaires). 1971. 38p. (In French and English). Dep. NTIS (U. S. Sales Only) $4.00.

A list of 217 references is presented in this 1971 bibliography on the chemical effects of nuclear transformations produced by neutrons (capture) or γ ray photons in various solids, solutions, and gases (chemistry of hot atoms, nuclear recoil, annealing, retention, radiolysis and photolysis). A classification of elements and isotopes (subject index) and an author's index are also presented. (France)

27442 PREPARATION OF ULTRAPURE ^{82}Br; THE HALF-LIFE OF ^{82m}Br. Collins, K. E. (Roswell Park Memorial Inst., Buffalo); Collins, C. H.; Kapauan, P. A.; Kapauan, A. F.; Kulch, R.; Taufig, A.; Amin Singgih, P. Radiochem. Radioanal. Lett.; 13: No. 3, 169-171(3 Apr 1973).

Bromine-82g containing no observable radioactive contaminants was prepared by a hot-atom chemical procedure. Samples pre-

pared by this procedure showed a half-life of 35.28 ± 0.01 h for bromine-82g decay. (auth)

27443 IMPORTANCE OF THE HOT REACTIONS OF IODINE PRODUCED BY THE NUCLEAR PROCESSES $^{127}I(n,\gamma)^{128}I$ AND $^{129}I(n,\gamma)^{130m}I$ IN THE PRESENCE OF METHANE. Kuhry, J. G.; Lagarde, G.; Heitz, C. (Univ. Louis Pasteur, Strasbourg). Radiochem. Radioanal. Lett.; 13: No. 3, 185-189(3 Apr 1973). (In French).

The addition of inert moderators (Ne,Ar) has no significant influence on the organic yield of iodine atoms produced by the $^{127}I(n,\gamma)^{128}I$ and $^{129}I(n,\gamma)^{130m}I$ reactions in methane. Results are interpreted assuming a very low contribution of hot processes. (auth)

27444 SZILARD-CHALMERS STUDY IN SYSTEMS WITH SIMULTANEOUS EXCHANGE. Brinn, I.; Sturm, J. E. (Lehigh Univ., Bethlehem, PA). An. Acad. Brasil. Cienc.; 44: No. 1, 61-65(1972). (In Portuguese).

The retention of organic activity following the process $^{127}I(n,\gamma)^{128}I$ was studied in aqueous CH_3I using $I^- - I_2 - I_3^-$ as the sweeping radical during addition to the system $C_2H_5Br - Br_2 - H_2O$ following the process $^{81}Br(n,\gamma)^{82}Br$. At room temperature exchanges occur between the organic forms and the inorganic forms in the primary system but not in the secondary. General equations, which permit the correction for an exchange which occurs in course of an experiment in which a nuclear transformation takes place, were derived. The exchange constants were determined experimentally. (tr-auth)

Properties of Radioactive Materials

Refer also to abstracts 27285, 27353, and 28079.

27445 (AREAEE-156) IN-LABORATORY PRODUCTION OF SOME ^{14}C LABELLED COMPOUNDS. Barakat, M. F.; Farag, A. N. (Atomic Energy Establishment, Cairo (Egypt). Nuclear Chemistry Dept.). 1972. 37p. Dep. NTIS (U. S. Sales Only) $4.00.

The methods and technical problems encountered when the wet oxidation technique was applied for preparing considerable amounts of carbon-14 labeled barium carbonate from irradiated A1N are discussed. Conversion of the initially obtained labeled impure barium carbonate into other labeled metallic carbonates and bicarbonates is also considered. Conditions that achieve minimum radioactivity loss during storage of the above mentioned labeled compounds are described. (auth)

27446 (CEA-CONF-2142) OXYDOREDUCTION REACTIONS BETWEEN VANADIUM AND URANIUM FLUORIDES. Reynes, J.; Bethuel, L.; Aubert, J. (Commissariat a l'Energie Atomique, Pierrelatte (France)). 1972. 11p. (In French and English). (CONF-700951-3). Dep. NTIS (U. S. Sales Only) $3.00.

From 3rd European fluorine chemistry symposium; Aix-en-Provence, France (14 Sep 1970).

Oxidoreduction reactions between vanadium and uranium fluorides were studied. The apparatus used is briefly described. The oxidizing reaction of VF_5 at 100 torr on UF_4 at temperatures of 50, 100, and 150°C leads to the production of VF_4 and UF_6 in a two stage process, the second stage being an equilibrium stage. The action of UF_6 at 70 torr on VF_4 at 70°C produces VF_5 + β-UF_5 (solid). The following equilibrium equation was established: VF_5(gas) + β-UF_5 (solid) reversible VF_4 (solid) + UF_6 (gas). The enthalpy of formation for UF_6 is −0.8 kcal/mole. The reaction between VF_5 and UO_2F_2 produces VOF_3 (gas) and UF_6. (France)

27447 (CONF-730402-8) STRUCTURAL STUDIES ON ORGANOMETALLIC COMPOUNDS OF LANTHANIDES AND ACTINIDES. Burns, J. H. (Oak Ridge National Lab., Tenn.). 1973. 9p. Dep. NTIS $3.00.

From 10th Rare Earth Research Conference; Carefree, Arizona, USA (30 Apr 1973).

Several organometallic compounds of lanthanides and actinides, including transuranic elements, have been the object of crystal structure analyses in recent years. Nearly all the compounds whose structures have been established contain ligands obtained from cyclopentadiene, indene, cyclooctatetraene, or their methylated derivatives; and the interest lies in the nature of the attachment of these rings to the various metals. Because there is a wide variety of geometrical configurations found for the ligands in their contact with the metals, it is only when structural data are used in conjunction with those from other physico-chemical measurements that satisfactory conclusions can be drawn regarding the nature of the organometallic bonding. (auth)

27448 (FRNC-TH-347) STUDY OF INTERACTIONS BETWEEN URANIUM HEXAFLUORIDE AND ALKALI FLUORIDES. Paillet, A. (Lyon Univ. (France)). 1972. 141p. (In French). Dep. NTIS (U. S. Sales Only) $9.25.

Thesis.

Some UF_6 and alkali fluoride complexes of the MF, UF_6 type were prepared. The kinetic and thermodynamic mechanisms of the reaction were studied. The complexes obtained were identified using x-ray diffraction techniques, Raman spectrography, and infrared spectrography. The complexing heats were directly measured using calorimetry. Two microcalorimeters were developed for the purpose. The kinetics of the reaction were studied. A certain number of hypotheses on the complexing mechanism were proposed from the kinetic curves and the mathematical processing of data obtained from simple models. (France)

27449 (JEN-237) PROGRAM VODAM FOR TREATMENT OF MINERAL PHYSICO-CHEMICAL DATA, WITH A SPECIAL APPLICATION TO THE URANIUM CASE. Santoma Juncadella, L. (Junta de Energia Nuclear, Madrid (Spain)). 1972. 41p. (In Spanish). Dep. NTIS (U. S. Sales Only) $4.25.

The VODAM program is written in FORTRAN IV language and makes a physico-chemical analysis of aqueous solutions of an element or a number of them. A thermodynamical data file is incorporated, and is useful in a low temperature range. (auth)

27450 (MLM-2007) THREE ACTINIDES EQUILIBRIUM PROBLEM. Silver, G. L. (Mound Lab., Miamisburg, Ohio). 16 Mar 1973. Contract AT-33-1-Gen-53. 35p. Dep. NTIS $3.00.

Much of the aqueous chemistry of uranium, neptunium, and plutonium can be represented by the solution of a single cubic equation. This equation may take the form of a statement of charge conservation for these elements in which the unknown variable is the ratio of hexavalent to pentavalent actinide. By assigning the relative proportion of pentavalent actinide the value of unity, the fraction of each of the other three valence states may be calculated. Tables of valence state distributions of uranium, neptunium, and plutonium as a function of average oxidation number and equilibrium acidity are presented, and two numerical methods for solving the cubic equation are illustrated with computer programs. Forbidden combinations of solution acidity and fraction of pentavalent plutonium are suggested, and a method of finding these forbidden combinations is proposed. (auth)

27451 RECENT PROGRESS IN ION-EXCHANGE STUDIES ON INSOLUBLE SALTS OF POLYBASIC METALS. Qureshi, M.; Qureshi, S. Z.; Gupta, J. P., Rathore, H. S. (Aligarh Muslim Univ., India). Separ. Sci.; 7: No. 6, 615-629(1972).

Progress in the chemistry of inorganic ion exchangers of the same generic type as zirconium phosphate (and including thorium and uranium compounds) is reviewed from 1964 to Aug. 1971. Some important separations in which inorganic exchangers are used are tabulated. (JGB)

27452 MECHANISM OF A SELECTIVE PERMEATION OF IONS THROUGH SOLVENT POLYMERIC MEMBRANES. Jagur-Grodzinski, J.; Marian, S.; Vofsi, D. (Weizmann Inst. of Science, Rehovot, Israel). Separ. Sci.; 8: No. 1, 33-44(1973).

The mechanism of diffusion of uranyl nitrate in "solvent polymeric membranes" was investigated. It is suggested that a "carrier" transport mechanism is responsible for the selective permeation of ions or ion pairs through such membranes. The fluidity of the membranes was investigated by proton magnetic resonance and by the "fluorescent probe" technique. Radioactive labeling was used in order to determine the self-diffusion coefficient of dicresylbutylphosphate (DCBP) which serves both as plasticizer and as complexing agent in such membranes. Comparison of its value (~10^{-7} cm^2/sec) with the limiting value of the diffusion coefficient of uranyl nitrate in such membranes (3.3 10^{-8} cm^2/sec) indicates that the latter diffuses as a $(DCBP)_2$ $UO_2(NO_3)_2$ complex. It is also suggested that the study of the "solvent polymeric membranes" may help to understand certain properties of biological membranes. (auth)

27453 DIELECTRIC RELAXATION OF TETRAHEDRAL, OCTAHEDRAL, AND CUBIC COMPLEXES OF ACETYLACETONE. DiCarlo, E. N.; Watson, E. Jr.; Varga, C. E.; Chamberlain, W. J. (Saint Joseph's Coll., Philadelphia). J. Phys. Chem.; 77: No. 8, 1073-1077(12 Apr 1973).

Recent studies have shown that several octahedral complexes of acetylacetone, which possess very high atom polarizations, exhibit considerable microwave losses in benzene solution which are consistent with unusually short dielectric relaxation times. These earlier observations have been extended to other acetylacetonates in which the linkages have a tetrahedral and cubic disposition to the central metal atom and a fairly clear general picture of the position has evolved. The relaxation times reported previously for Cr(III), Fe(III), Co(III), and Al(III) acetylacetonates are vir-

tually identical with those found for the acetylacetonates of Be III, Th(IV), and Zr(IV). The latter consistency and the magnitude of the individual relaxation times (in all cases 4 to 5 psec, 60°C) indicate a common relaxation process of surprisingly high frequency for these octahedral, tetrahedral, and cubic complexes. The observed losses are shown not to be relaxation losses of permanent dipoles in agreement with other evidence which favors completely symmetrical structures for these molecules. Consideration of various alternatives suggests that the microwave losses are most probably connected with an intramolecular relaxation process involving highly damped oscillations of the chelate rings relative to the remainder of the molecule. It therefore appears that a considerable fraction of the total atom polarization of each of these substances is associated with absorption in the centimeter and millimeter wavelength region while the remainder arises from the usual infrared absorption. (auth)

27454 GENERAL ASPECTS OF THE PURIFICATION BY RECTIFICATION OF URANIUM HEXAFLUORIDE. Estaban Duque, A.; Rojas de Diego, J. L. (Junta Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 16: No. 78, 465-477(1972). (In Spanish).

The physical and radioactive properties of uranium hexafluoride and the specifications placed on it by producer countries are given. The possible derivations and characteristics of UF_6, types of impurities, methods of purification, and the experiences of the JEN are summarized. (tr-auth)

27455 PRODUCTION OF RADIOACTIVE PREPARATIONS. IV. The Choice of an Optimum Adsorbent for Cleaning the ^{131}I Albumin Microaggregates From Inorganic Iodine Forms. Bazhenova, T. L.; Moshayski, A. M.; Koulokov, V. N.; Stanko, V. I. (Inst. of Biophysics, Moscow). Isotopenpraxis; 8: No. 11-12, 460-462(1972). (In Russian).

Optimum adsorbents for cleaning ^{131}I albumin microaggregates were chosen. It is shown that the use of AV-17 type resin mixed with Sephadex G-75 makes possible the fast removal of inorganic ^{131}I admixtures from the ^{131}I albumin microaggregate solution. Radiochemical purity reaches 99% and is maintained during the whole storage time. (auth)

27456 RADIOACTIVE-KRYPTONATION OF METALS BY FILM EVAPORATION. Bodys, J. W. S.; Campbell, K. C. (Univ. of Glasgow, Scotland). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 107-113(Feb 1973).

^{85}Kr-labelled krypton was incorporated into nickel, iron and copper by evaporation of these metals in a low pressure of krypton to form a metal film on a substrate at 77°K. A substantial amount of krypton was lost below 200°K when the temperature was allowed to rise: thereafter loss with respect to further rise of temperature was much smaller. Typical nickel films at ambient temperature (295°K) showed activities of 65 mCi/g. Dissolution of nickel films in dilute nitric acid, and reaction of copper films with oxygen revealed that the krypton was uniformly distributed in the metals. As a consequence of this, metals kryptonated by this method should be particularly suitable for analytical chemical applications. (auth)

27457 PLUTONIUM TELLURIDES. Damien, D. (CEN, Fontenay-aux-Roses, France). Inorg. Nucl. Chem. Lett.; 9: No. 4, 453-456(Apr 1973).

The preparation and crystallographic characterization of plutonium tritelluride and the thermal dissociation of this compound leading to the formation of the lower telluride phases ditelluride, η-sesquitelluride, and γ-sesquitelluride are described. (auth)

27458 POTENTIOMETRIC DETERMINATION OF STEPWISE STABILITY CONSTANTS OF ZIRCONIUM, THORIUM, AND URANIUM CHELATES OF ASPARAGINE AND GLUTAMINE. Tewari, R. C.; Srivastava, M. N. (Univ. of Allahabad, India). Talanta; 20: No. 3, 360-361(Mar 1973).

The metal chelates of Zr(IV), Th(IV), and U(VI) with asparagine and glutamine were studied potentiometrically. Stepwise stability constants in 0.1M sodium perchlorate at 25°C follow. They are for asparaginate chelates: log K_1 8.80, log K_2 6.25 for Zr; log K_1 6.79, log K_2 6.16 for U; log K_1 8.28, log K_2 7.77, and log K_3 7.72 for Th. They are for glutaminate chelates: log K_1 8.75, log K_2 6.10 for Zr; log K_1 6.63, log K_2 6.22 for U; log K_1 8.30, log K_2 7.61, and log K_3 7.55 for Th. (auth)

27459 PREPARATION OF ^{14}C LABELLED ANTIBODIES. Oliphant, G.; Brackett, B. G. (Univ. of Pennsylvania, Philadelphia). Immunochemistry; 9: No. 12, 1269-1261(Dec 1972).

An easy method is described for ^{14}C labelling of antibodies at a level of radioactivity which is readily observed, with a minimum of molecular alteration. By this method large amounts of antiserum can be labelled which are stable for long periods of time. (UK)

27460 PREPARATION, PROPERTIES, AND CRYSTAL STRUCTURE OF BIS(ETHYL CARBAMATE)-DINITRATO-DIOXOURANIUM(VI). Graziani, R. (Univ., Padua); Bombieri, G.; Forsellini, E.; Degetto, S.; Marangoni, G. J. Chem. Soc., Dalton Trans.; No. 4, 451-454(1973).

A monomeric complex of formula $[UO_2(NO_3)_2L_2]$ (L = ethyl carbamate) was synthesized and characterized. The crystal structure was determined by x-ray analysis from three-dimensional counter data, and refined by least-squares to R 0.076 for 1369 reflections. Crystals are monoclinic, space group $P2_1/a$, with a = 12.176(3), b = 8.364(3), c = 7.847(3) Å, β = 90.42°(5) and Z = 2. The linear uranyl group is perpendicular to the equatorial plane in which four oxygen atoms of two nitrate groups and two amidic oxygen atoms of the organic ligands occupy the corners of an irregular hexagon. The crystallographic results are related to ir and NMR measurements. (auth)

27461 THERMODYNAMICS OF THE ACTINIDE ELEMENTS. Pt. 4. Heats and Free Energies of Formation of the Tetrachlorides, Tetrabromides, and Tetraiodides of Thorium, Uranium, and Neptunium. Fuger, J. (Univ., Liege); Brown, D. J. Chem. Soc., Dalton Trans.; No. 4, 428-434(1973).

Heats of solution measured at 298.15 ± 0.05 K for $ThCl_4(s)$, $ThBr_4(s)$, $ThI_4(s)$, $UBr(s)$, $UI_4(s)$, and $NpBr_4(s)$ in 1M−HCl are −241.8 ± 0.7, −283.5 ± 1.3, −322.0 ± 0.6, −264.6 ± 0.5, −289.9 ± 1.3, and −258.8 ± 0.5 kJ mol^{-1} respectively, and in 6M−HCl, −188.3 ± 0.4, −233.9 ± 0.8, −276.0 ± 1.2, −205.7 ± 0.9, −240.2 ± 1.3, and −199.2 ± 0.4 kJ mol^{-1} respectively. Combination of these values with other thermodynamic data yields the following standard heats of formation: $ThCl_4(s)$, −1184.4 ± 1.0 kJ mol^{-1}; $ThBr_4(s)$, −963.4 ± 1.4 kJ mol^{-1}; $ThI_4(s)$, −662.0 ± 1.8 kJ mol^{-1}; $UBr_4(s)$, −802.5 ± 3.4 kJ mol^{-1}; $UI_4(s)$, −511.5 ± 4.0 kJ mol^{-1}; and $NpBr_4(s)$, −773.2 ± 1.7 kJ mol^{-1}. By use of suitable entropy and heat capacity data, the thermodynamic functions associated with the formation of these compounds, and of $UCl_4(s)$ and $NpCl_4(s)$, have been calculated as a function of temperature from 298°K to the m.p. of the halide. (auth)

27462 STABILITY OF THE LACTATE COMPLEXES OF LANTHANUM, SCANDIUM, LUTETIUM, AND THORIUM IN ALCOHOL−WATER MIXTURES. Lisovaya, L. P.; Skorik, N. A. (Tomsk State Univ., USSR). Zh. Neorg. Khim.; 18: No. 4, 1134-1135(Apr 1973). (In Russian).

The stability constants of the La, Lu, Sc, and Th lactate complexes were determined at 25°C in water and in alcohol−water mixtures containing 19.8, 30.0, and 40.3 mass % of ethanol. A linear dependence existed between the logarithm of the stability constants of these complexes (at J = 0) and the inverse of the dielectric permeability of the solvent. (tr-auth)

27463 PREPARATION AND CRYSTAL STRUCTURE OF BIS(TROPOLONATO)-DIOXO(PYRIDINE) URANIUM(VI). Bombieri, G.; Degetto, S.; Marangoni, G.; Graziani, R.; Forsellini, E. (Consiglio Nazionale delle Ricerche, Padua). Inorg. Nucl. Chem. Lett.; 9: No. 2, 233-236(Feb 1973).

Chelates formed between tropolone and a wide range of elements are known. In particular, the ability of tropolone to form very stable solid complexes with the uranyl(VI) ion in the ratios 2:1 and 3:1 has been pointed out. This class of compounds was extended by synthesizing a number of complexes having the general formula $UO_2(T)_2L$ ($T = C_7H_5O_2^-$, tropolonate ion), where L is either an oxygen neutral donor (pyridine-N-oxide, triphenylphosphine oxide, dimethylsulphoxide, methanol, water and acetone) or a nitrogen donor (pyridine), or a mixed oxygen-nitrogen donor (ethyluretane, urea, glycine) in order to determine the coordination number in the solid state. In particular bright-red crystals of $UO_2(T)_2$ pyridine were obtained by reaction of $UO_2(T)_2MeOH$ with an excess of pyridine. (auth)

27464 CONVENIENT METHOD FOR PREPARATION OF ^{14}C-LABELLED BASIC NUCLEAR PROTEIN-HISTONE. Havranek, M.; Veres, K. (Isotopova Laborator Biologickych Usatvu, Prague). J. Label. Compounds; 8: No. 4, 705-708(1972).

In the case of basic proteins, e.g., histone, it is convenient to carry out substitution of free hydrogen atoms of the ϵ-amino groups of lysine by labelled glycine. Histone labelled with radioisotopes in its amino acids was prepared so far only biosynthetically. In addition preparations with a very low specific radioactivity, as for example, the lysyl-^{14}C-histone prepared from Ehrlich ascites tumor after in vitro labelling with lysine-^{14}C, had a specific activity of 100 to 500 dmp/umol lysine. The method described enables the synthesis of preparations with much higher specific activities, and, at the same time, the radioactive material is utilized more economically. (BE)

27465 TETRAKIS(DIETHYLAMIDO)THORIUM(IV). A Volatile Compound of Thorium. Watt, G. W.; Gadd, K. F. (Univ. of Texas, Austin). Inorg. Nucl. Chem. Lett.; 9: No. 2, 203-205(Feb 1973).

Interest in volatile compounds of the actinide elements prompted an investigation of the reaction between lithium diethylamide and thorium tetrachloride. The analogous reaction with UCl_4 reported to yield a distillable liquid product, characterized as $U(NEt_2)_4$, and the corresponding Ti and Zr compounds (also volatile) have been prepared similarly. $U(NEt_2)_4$ was prepared to compare its properties with those of the product from the $ThCl_4$ reaction. Previous to this work the most volatile compound of Th isolated was $Th(OCMeEt^iPr)_4$. (auth)

27466 NEPTUNIUM DIARSENIDE AND MONOARSENIDE. Charvillat, J. P.; Damien, D. (CEN, Fontenay-aux-Roses, France). Inorg. Nucl. Chem. Lett.; 9: No. 3, 337-342(Mar 1973).

As part of a systematic effort to study the crystal chemistry of the transuranium element chalcogenides and pnictides, the preparation, crystallographic characterization, and thermal stability of neptunium diarsenide and monoarsenide are reported. (auth)

27467 COMPLEXING OF URANYL IONS IN ACETATE SOLUTIONS AT TEMPERATURES FROM 25 TO 150°C. Nikolaeva, N. M.; Pirozhkov, A. V.; Antipina, V. A. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 5, 52-58(Sep 1972). (In Russian).

Stability constants for uranyl acetate complexes UO_2Ac^+ were determined by the pH-metric method at temperatures from 25 to 150°C. The equation for the temperature dependence of constants was found to be $\lg K = -6.52 + 1050/T$. The values of $\Delta H^0_{289} = -4.8$ kcal/mole, $\Delta S^0_{289} = -30$ eu, $\Delta G^0_{298} = 4.1$ kcal/mole were estimated for the dissociation reaction of UO_2Ac^+. (auth)

27468 PROCESS FOR THE PREPARATION OF NITROGENOUS COMPOUNDS OF URANIUM. Yumi, A. (To Mitsubishi Kinzoku Kogyo KK). Belgian Patent 704,729. 5 Oct 1967. Priority Date 6 Oct 1966, Japan.

A process is described for the preparation of uranium mononitride or uranium carbonitride in which a raw material of uranium carbide base that is industrially cheap (advantageous) is heated to a temperature of at least 300°C to make it react with dry ammonia. All or a part of the carbon compound contained in the raw material in the form of a gaseous hydrocarbon is separated in order to obtain the nitrogen-containing compounds of uranium. The product thus obtained is then subjected to a treatment at a high temperature. (BE)

27469 PARAMAGNETIC SHIFTS IN THE PROTON MAGNETIC RESONANCE SPECTRUM OF TETRA(ALLYL)URANIUM(IV) AND TETRA(2-METHYLALLYL)URANIUM(IV). Brunelli, M.; Lugli, G. (Societa Nazionale Metanodotti, Milan). J. Magn. Resonance; 9: No. 2, 247-254(Feb 1973).

Data on the paramagnetic shifts of proton magnetic resonance signals of tetra(allyl)uranium(IV) and tetra(2-methylallyl)uranium(IV) are presented. The temperature dependence of the shifts is discussed in terms of the Kurland–McGarvey (J. Magn. Resonance; 2: 286(1970)) theory of the contact and pseudo-contact interactions. On the basis of the comparison between the methylated and the parent compounds a separation of the two contributions is proposed. (auth)

27470 PREPARATION METHODS OF LIVER AND LUNG RADIO PHARMACEUTICALS WITH ^{113m}In. Aasard, P. E.; Bois-Svensson, I. Acta Radiol., Ther., Phys., Biol.; 11: No. 3, 240-256(Jun 1972).

A new and simple method of preparing ^{113m}In-MAA is presented together with tests of colloids labelled with ^{87m}Sr, ^{99m}Tc, and ^{113m}In and lung scanning agents labelled with these. No stabilizers are used for the colloids. (auth) (Sweden)

27471 TRITIUM CONTAMINATION OF DEUTERIUM COMPOUNDS. Campbell, J. R. (Aldrich Chemical Co., Inc., Milwaukee). Nature (London); 241: No. 5390, 449(16 Feb 1973).

Reference is made to reports that have appeared alleging that some commercial deuterated reagents contain appreciable quantities of T, and it is stated that this is no longer the case; there has been a dramatic reduction in T content of recent D_2O samples, at least in those obtained from the USAEC. Analytical results are given. (UK)

Radioactive Waste Treatment

Refer also to abstract 29503.

27472 (CEA-N-1555) STUDY OF THE SOLIDIFICATION OF FISSION PRODUCT SOLUTIONS (JANUARY–JULY 1971). Cartier, R.; Jouan, A.; Laude, F.; Pacaud, F.; Rabot, G. (Commissariat a l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium de Marcoule). Oct 1972. 65p. (In French). Dep. NTIS (U. S. Sales Only) $5.25.

The most important events that took place during the six month period considered are: the first active runs of the VULCAIN cell (for the manufacture of glass pellets with a Sicral type simulated solution and the leaching of the glass blocks obtained); the termination of investigations of the vitrification of Sicral type fluorinated solutions, the development of a series of glasses, and the vitrification of pot of Sicral type fluorinated simulated solutions; continuous calcination and vitrification tests were carried out (interesting results were obtained in both these fields during several 100 hour tests on the continuous processing of Sicral type concentrated solutions; the use of a reflux column enabled the recycling of the gast dust towards the calcinator to be satisfactorily carried out); the fourth phase of the vitrification program of PIVER is almost finished (since its startup PIVER has processed a volume of concentrated fission product solution representing more than 540 tons of irradiated fuel). (auth)

27473 (CEA-R-4378) SOLIDIFICATION OF MEDIUM ACTIVITY LIQUID RESIDUES WITH BITUMEN. Lefillatre, G.; Rodi, L. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Feb 1973. 90p. (In French). Dep. NTIS (U. S. Sales Only) $6.50.

The solidification of 14 different types of radioactive liquid residues with bitumen was studied from the point of view of laboratory research on the long term storage of waste products and from the technological point of view concerning the utilization of the technique in industrial installations. The type of residue studied corresponded to the sort of liquids produced in plants reprocessing irradiated fuels, nuclear power plants, and nuclear research centers. The research was conducted in the following fields: the insolubility of radioisotopes present in residues; leaching with water the radioactivity of evaporation concentrates, which had or had not been solidified with bitumen, the parameters affecting the leaching process being measured; investigations of the behavior of coated products after prolonged immersion in water; the behavior of coated products when subjected to external irradiation; risks associated with storage, inflammability of residues, and the sedimentation of salts. The technological studies were carried out on two pilot installations, both of which used a continuous coating apparatus having similar operational capacities, but different conceptions. The first was equipped with a thin film evaporator (LUWA L 150) and was used for coating evaporation concentrates from nuclear research centers and liquid residues from nuclear plants. The second was equipped with a double threaded extruding device (WERNER and PFLEIDERER ZDS T 83) and was used for coating evaporation concentrates from plants reprocessing irradiated fuels with bitumen. Active tests with residues having specific activities between 2 and 5 $Ci \times m^{-3}$ enabled the decontamination factors for the two types of apparatus to be determined for $^{106}Ru-^{106}Rh$. They are 2 to 4×10^3 for the thin film evaporator and 1×10^4 for the double threaded evaporator. The atmospheric contamination risks associated with the transferring of solid residues into drums was also estimated (almost zero in both cases); the decontamination facilities of both installations were controlled. (auth)

27474 REMOVAL EFFICIENCY OF ACTIVATED CHARCOAL FILTER IN THE VENTILATION SYSTEM OF A LARGE-SCALE ^{131}I PRODUCTION FACILITY. Izumo, M.; Iguchi, A.; Yamaguchi, I.; Sato, A.; Akaishi, S. (Japan Atomic Energy Research Inst., Tokai). Nippon Genshiryoku Gakkaishi; 14: No. 10, 540-546(Oct 1972). (In Japanese).

An air-cleaning system embodying activated charcoal filters was constructed for a large-scale ^{131}I production facility at the Japan Atomic Energy Research Institute, for the purpose of removing ^{131}I released continuously into the exhaust air stream from the production facility. The system was continuously operated for about 47 months, and changes in the removal efficiency of the ^{131}I filter for the exhaust air stream was observed during this period. In one run of ^{131}I production, the removal efficiency changed significantly, possibly due to a change in the chemical form of ^{131}I released, accompanying the progress of the ^{131}I production process. When operated at the maximum air flow rate of the filter, it showed an efficiency greater than 90% on the average over a period of 20 months. (auth)

27475 PROCESSING OF THORIATED TUNGSTEN WASTES. Balikhin, V. S.; Reznichenko, V. A.; Korneeva, S. G.; Korchagin, I. V.; Krepkov, P. N. Tsvetn. Metal.; No. 11, 65-67(Nov 1972). (In Russian).

In the processing of thoriated tungsten wastes, the possibility of complete separation of the alloy into its components (W–1 to 5% ThO_2) was considered. Anode dissolution of the wastes in an alkali medium yielded a solution of 260 to 300 g W/liter, and slimes which averaged 90% ThO_2. (KSW)

27476 DEPOSITION OF RADIOISOTOPES ON BENTONITE UNDER DYNAMIC CONDITIONS. Prokoshev, V. A.; Miskarli, A. K. Azerb. Khim. Zh.; No. 2, 156-158(1972). (In Russian).

Experiments established that bentonite which had been granulated and then heated to 400°C for 4 hr possessed a high sorption capacity for a mixture of radioisotopes under flow conditions. Microquantities of ^{137}Cs were particularly efficiently held on a bed of bentonite. The Na-form of bentonite yields even better results. (KSW)

Radioisotope Production

27477 (ORNL-4672) FINAL ISOLATION AND PURIFICATION OF THE TRANSPLUTONIUM ELEMENTS FROM THE TWELVE CAMPAIGNS CONDUCTED AT TRU DURING THE PERIOD AUGUST 1967 TO DECEMBER 1971. Baybarz, R. D.; Knauer, J. B.; Orr, P. B. (Oak Ridge National Lab., Tenn.). Apr 1973. Contract W-7405-eng-26. 42p. Dep. NTIS $3.00.

Problems previously encountered in the final purification and isolation of the transplutonium elements have largely been resolved by the development of new equipment and techniques. Control of the LiCl anion exchange process has been assumed by TRU Operations, and the cation exchange process has been improved by use of the pressurized system. A new Californium Facility has become operational, making possible the isolation of pure ^{248}Cm. A total of 313 mg of ^{252}Cf, 1140 μg of ^{253}Es, 30 mg of ^{249}Bk, 1.7 mg of ^{249}Cf, 7.8 mg of ^{248}Cm, and 4.5×10^9 atoms of ^{257}Fm were isolated and purified in the 12 campaigns carried out during the period from August 1967 to December 1971. (auth)

27478 PREPARATION OF CARRIER-FREE ^{43}K COMBINED WITH ^{42}K FROM CALCIUM HYDROXIDE USING A LINEAR ACCELERATOR. Tsai, C. M.; Izawa, G.; Shiokawa, T. (Tohoku Univ., Sendai). Radiochem. Radioanal. Lett.; 13: No. 3, 179-183 (3 Apr 1973).

Millicurie quantities of carrier-free ^{43}K combined with ^{42}K were produced by the reactions $^{43}Ca(\gamma,p)^{42}K$, $^{44}Ca(\gamma,p)^{43}K$ and $^{44}Ca(\gamma,np)$ ^{42}K on calcium hydroxide target by the high energy bremsstrahlung irradiation from an electron linear accelerator. A procedure was developed to obtain the carrier-free ^{43}K and ^{42}K by precipitation and ion exchange purification from the irradiated calcium hydroxide target. (auth)

27479 NOVEL WAY OF PRODUCING ^{38}S. Lindner, L.; Visser, J.; Drost-Wildschut, H. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 121-124(Feb 1973).

Possible methods of production of ^{38}S, the only sulfur isotope having a reasonable half-life (170 min) and γ-ray emission, are reviewed. The novel method of production of ^{38}S by a linear electron accelerator with a beam energy of 80 to 90 MeV using the reaction $^{40}Ar(\gamma,2p)^{38}S$ is described. Using solid argon as a target and a beam current of several tens of μA yields of the order of 100 μCi were obtained. With longer irradiation times, higher electron beam currents, a different conversion target, more target material and improved geometry of the target relative to the beam it is considered that the yield could be raised to several mCi. The advantages and disadvantages (especially the production of the daughter ^{38}Cl) of the use of ^{38}S in the biomedical and industrial fields are considered. (UK)

27480 PROPERTIES OF FISSION PRODUCTS FROM THERMAL NEUTRON FISSION OF ^{235}U AND ^{239}Pu. Krueger, F. W. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 15: No. 9, 311-317(Sep 1972). (In German).

The properties of fission products, chemical composition, shutdown heat production, gamma-ray emission, and gamma-ray spectrum, were calculated as a function of operational parameters: generation time, neutron flux during generation, decay time, and type of fissile material (^{235}U or ^{239}Pu). The parameters were varied in a range typical for fission product formation in thermal power reactors. The effect of operational parameters on the properties of the fission products is discussed in detail. (auth)

27481 DYNAMIC LOOP-TARGET FOR THE IN-CYCLOTRON PRODUCTION OF ^{18}F BY THE $^{16}O(\alpha,d)^{18}F$ REACTION ON WATER. Lindner, L.; Suer, T. H. G. A.; Brinkman, G. A.; Veenboer, J. T. (Instituut voor Kernphysisch Onderoek, Amsterdam). Inst. J. Appl. Radiat. Isotop.; 24: No. 2, 124-126(Feb 1973).

A method of cyclotron production of ^{18}F in mCi amounts using water as the target material is given. Internal $^4He^2$ beams are used at an energy of 52 MeV with currents of about 5 μA. The target holder is a thin-walled cell which is part of a closed loop through which a limited amount of target water is circulated. Cooling is achieved by passing the water through a heat-exchanger while the O_2 and H_2 formed from radiation decomposition are allowed to escape freely. The ^{18}F produced is trapped on an anion-exchange column in the target system and cationic impurities are removed by a cation-exchange column. Recovery of the ^{18}F is achieved by stripping the resin with an isotonic saline solution. The method is simple and reliable, the yields obtained amounting to 7 mCi/Ah in a 1 h irradiation of chemically and radiochemically pure isotonic solution of carrier free ^{18}F as the fluoride. With precautions to ensure sterility and the absence of pyrogens the material can be used for direct administration to patients. (UK)

27482 COMPLETE RECOVERY OF TETRAVALENT METALS, PARTICULARLY OF Pu, FROM PHOSPHOORGANIC ACID COMPOUNDS. (To Gesellschaft fuer Kernforschung mbH). Belgian Patent 729,807. 13 Mar 1969. (Priority date 13 Mar 1968, Federal Republic of Germany (F.R. Germany).

A procedure is described for the complete recovery of tetravalent metals, especially tetravalent actinides and particularly plutonium, starting with organic compounds of phosphorus acids forming complexes that are particularly stable with tetravalent metals. They can be used as extraction agents or as additions in a mixture of extraction agents. They can also be used by decomposition of neutral organic compounds of phosphorus in the aqueous phase characterized by the fact that during the recovery an aqueous solution of tetravalent uranium is used. (BE)

27483 INVESTIGATION OF THE RADIOACTIVE PURITY OF A ^{59}Ni PREPARATION: REMOVAL OF ^{54}Mn AND ^{134}Cs IMPURITIES. Ujhelyi, C.; Menes, A. ATOMKI (At. Kut. Intez.) Kozlem.; 14: No. 4, 239-249(1972). (In Hungarian).

The ^{59}Ni was produced in a reactor at a flux of 10^{14} neutrons/$cm^2 \cdot$ sec. ^{58}Ni/enriched to 99.9% was used as a target material. The radioactive purity of the preparation was checked by means of a Ge(Li) gamma-ray spectrometer. ^{54}Mn and ^{134}Cs impurities were found. A procedure was elaborated to remove the carrier-free ^{54}Mn and ^{134}Cs from the ^{59}Ni preparation of approximately 0.4 gram. After the addition of carrier, the ^{54}Mn in the form of precipitate $MnO(OH)_2$ was removed from the solution of Ni–ammine complex containing NH_4OH and NH_4Cl. Giving carrier to the filtrate, the ^{59}Ni in the form of precipitate $Ni(OH)_2$ was separated from the ^{134}Cs after having decomposed the Ni–ammine complex by NaOH. The different stages of the purification were checked by taking spectra with the Ge(Li) spectrometer. (auth)

Reactor Fuel Reprocessing

27484 (DOCKET-50268-41) MIDWEST FUEL RECOVERY PLANT. Preoperational Tests. (General Electric Co., San Jose, Calif. Nuclear Energy Div.). 8 Mar 1973. 10p. (NEDO-10178-15). Dep. NTIS $3.00.

Response is given to AEC staff questions concerning NEDO 10178-15 preoperational tests at Midwest Fuel Recovery Plant. Subjects considered include: test results demonstrating the operability of the fire control system, results of testing shutdown procedures including switchover operations to emergency power and restart capability, results of the testing of emergency plans and equipment, description of cask receipt experience including difficulties encountered, extent of basin water contamination and adequacy of shielding and basin radioactivity clean-up system, and adequacy of the temporary venting and flushing arrangement. (DHM)

27485 (DOCKET-50268-42) MIDWEST FUEL RECOVERY PLANT. Order Extending Provisional Construction Permit Completion Date to April 1, 1974. (Directorate of Licensing (AEC), Washington, D. C.). 30 Mar 1973. 4p. Dep. NTIS $3.00.

27486 (KFK-1716) CONTROL OF AN EVAPORATOR FOR THE CONTINUOUS CONCENTRATION OF U, Th, AND Pu SOLUTION. Bier, K.; Radek, S.; Baumgaertel, G. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie). Dec 1972. 20p. (In German). Dep. NTIS (U. S. Sales Only) $3.00.

A cascade control system is reported for a uranium evaporator. For this control a rapid regulation process (control of heating) is connected with a slow regulation process (control of concentration). The continuous measurement of the concentration of the evaporator concentrate will be realized by an in-line γ absorptiometer. (auth)

27487 (ORNL-TM-4016) LMFBR FUEL CYCLE STUDIES PROGRESS REPORT FOR SEPTEMBER 1972, No. 43: AQUEOUS FUEL REPROCESSING. Unger, W. E.; Blanco, R. E.; Crouse, D. J.; Irvine, A. R.; Watson, C. D. (Oak Ridge National Lab., Tenn.). Nov 1972. Contract W-7405-eng-26. 29p. Dep. NTIS $3.00.

A report is presented that continues a series outlining progress in the development of methods for the reprocessing of LMFBR fuels. Development work is reported on problems of irradiated fuel transport to the processing facility, the dissolution of the fuel and the chemical recovery of PuO_2-UO_2 values, the containment of volatile fission products, product purification, conversion of fuel processing plant product nitrate solutions to solids suitable for shipping and for subsequent fuel fabrication. Pertinent experimental results are presented for the information of those immediately concerned with the field. (auth)

27488 PROCESSING OF RESIDUES OF HIGH RADIOACTIVITY FROM THE REPROCESSING OF THE FUELS OF COMMERCIAL REACTORS. Ortega Abellan, J. (Junta Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 16: No. 78, 453-463(1972). (In Spanish).

The operation of a reprocessing plant implies the treatment of the radioactive residues which contain almost all the fission products formed during the residence of the fuel in the reactor. The problems presented by the treatment of these radioactive residues and the solutions adopted in the existing plants for their concentration and solidification are outlined. (tr-auth)

27489 IRRADIATED FUEL RECOVERY SYSTEM. Weech, M. E. (to General Electric Co.). U. S. Patent 3,714,324. 30 Jan 1973. Filed date 18 Jun 1968. 10p.

A process for recovering irradiated nuclear reactor fuel material is disclosed. This process includes extracting uranium, plutonium, and neptunium from a solution of irradiated fuel, passing this stream to a reflux column, where a high saturation of uranium is maintained. Separation of uranium from plutonium and neptunium and further decontamination of uranium result from this high saturation. This process is simple, has a high recovery efficiency and high decontamination, uses relatively small amounts of process reagents, and produces a relatively small volume of radioactive waste material. (Official Gazette)

27490 PLUTONIUM DISSOLUTION AND PLUTONIUM ALKOXIDE PRODUCT. Pitts, S. H. Jr. (to United States Atomic Energy Commission). U. S. Patent 3,718,677. 27 Feb 1973. Filed date 29 Dec 1971. 6p.

Nonaqueous methods of dissolving plutonium and products formed are described. Plutonium is submerged in a bath containing an alkyl alcohol taken from the group ROH, where R is an alkyl radical having from 1 to 4 atoms of carbon, and a halogen, either as an absorbed gas or as a compound such as RX_n, where R is a straight chain alkyl radical and X is a halide. The solution is filtered after dissolution is complete, and the filtrate evaporated to yield a plutonium compound. (Official Gazette)

27491 PROCESS AND APPARATUS FOR CONTINUOUS DISSOLUTION OF CANNED NUCLEAR FUELS. (To Saint Gobain Techniques Nouvelles). Belgain Patent 721,798. 3 Oct 1968. Priority Date 24 Sep 1968, France.

27492 PROBLEMS IN THE WET REPROCESSING OF FAST-REACTOR FUELS. Genshi Doryoku Kenkyukai Teiret Kenkyukai Nenkai Hokokusho; No. 45, vp. (Aug 1971). (In Japanese).

World status to cope with the development of wet reprocessing is reviewed. As for technical aspects, the following are presented: head end process, electrolytic dissolution, shear-leach reprocessing, the effect of irradiation on fuel solubility, and ambiguity in extrapolating from laboratory experiment to actual plant operation. (Japan)

27493 ON-LINE MEASUREMENTS IN NUCLEAR FUEL REPROCESSING PLANTS. Edeline, J. C. (CEN de Saclay, Gif-sur-Yvette, France). Ind. At. Spatiales; 16: No. 6, 40-47 (Dec 1972). (In French).

The reasons behind the envisaged developments in the application of on-line analysis to irradiated fuel reprocessing plants are presented. The different types of measurement device currently used are described: pH meters, conductivity measurement meters, γ counters for controlling the fission product decontamination of the solution, γ absorption measurement meters, neutron counters in mixer-settler batteries, α detectors, and means for measuring induced fissions. The results obtained with such apparatus are given. Studies currently being conducted are presented together with equipment for measuring the isotopic concentration of fuels from their γ ray emission characteristics. The necessity of envisaging the positioning of measurement devices at the plant construction stage in order to reduce the cost of on-line data analysis is emphasized. (France)

27494 VOLOXIDATION EXPERIMENTS FOR PLUTONIUM REPROCESSING. Sari, C. (EURATOM, Karlsruhe, Ger.). Energ. Nucl. (Milan); 20: No. 3, 171-176(Mar 1973).

The voloxidation experiments are described that were carried out at the Institute for Transuranium Elements of Euratom-Karlsruhe (German Fed. Rep.) using uranium oxide and uranium-plutonium mixed oxides, both pure and doped with synthetic fission products simulating a burnup of 5% and 10% FIMA. Before oxidation the material was submitted to a radial temperature gradient similar to that existing under irradiation. The results show that the voloxidation process is a valid technique for the separation of the spent uranium-plutonium fuel from the cladding material if the plutonium content is $Pu/(U + Pu) \leq 0.25$. The recommended temperature is 600°C. (auth)

27495 DECLADDING OF BREEDER REACTOR FUELS BY DISSOLUTION IN Sb-Cu LIQUID METAL: SOLINOX PROCESS. Wurm, J. G. (EURATOM, Brussels); Avogadro, A.; Heylen, P. R.; De Beukelaer, R.; De Coninck, A. Energ. Nucl. (Paris); 14: No. 5, 367-373(Oct 1972). (In French)

The fuel of the first generation breeders is composed of mixed oxides (UO_2-PuO_2); 304 L or 316 stainless steel is envisaged for the cladding. The development of a decladding technique using liquid metals (Solinox) led to the investigation of solvent alloys. The research led to the utilization of Sb-Cu alloys containing 10, 15, and 23.4% by weight of Cu. The dissolution kinetics of stainless steels were studied as a function of temperature and of the various different Sb-Cu alloy compositions. The decladding installation, which has a 300 t of fuel/year capacity, is described. Considerations on the amount of the fuel discharged from a reactor are presented together with the economics. (France)

ENGINEERING

Energy Conversion

Refer also to abstract 29803.

27496 (JPRS-58612-1) POWER SYSTEMS FOR SPACECRAFT. Part I and II. Kulandin, A. A.; Timashev, S. V.; Ivanov, V. P. 30 Mar 1973. Translation of Energeticheskie Sistemy Kosmicheskikh Apparatov, Mashinostroenie Izdatel'stvo, Moscow, 1972. 269p. NTIS.

Problems concerning the structure, operating principles, and theoretical fundamentals of the operating process of onboard power and propulsion systems are discussed. (auth)

27497 (JPRS-58612-2) POWER SYSTEMS FOR SPACECRAFT. Part III. Kulandin, A. A.; Timashev, S. V.; Ivanov, V. P. 30 Mar 1973. Translation of Energeticheskie Sistemy Kosmicheskikh Apparatov, Mashinostroenie Izdatel'stvo, Moscow, 1972. 195p. NTIS.

Problems concerning the structure operating principles and theoretical fundamentals of the operating process of onboard power and propulsion systems are discussed. (auth)

27498 (JUL-892-TP) APPLIED MAGNETOHYDRODYNAMICS. Vol. 11. Outlook and Possibility for MHD Gas Combustion Generators With Air Turbine for Nuclear Plant Application in the BRD. Noack, G. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Technische Physik). Oct 1972. 155p. (In German). Dep. NTIS (U. S. Sales Only) $9.75.

Based on the present and on the projected energy needs of West Germany, MHD generators with gas fuel are analyzed. The analysis considers natural gas and air enriched with oxygen to obtain the high temperatures required by the MHD generator. Data about high flame temperatures are listed and discussed in detail. Under the conditions prevailing in West Germany, the best arrangement is offered by an MHD generator with subsequent air turbine. The design of such an arrangement is discussed thoroughly from the technical as well as the structural point of view. (HBG)

27499 THERMOELECTRIC GENERATOR. Winkler, J.; Falkenberg, D. (to Siemens, AG). Canadian Patent 908,881. 29 Aug 1972. Priority date 24 Oct 1968, Federal Republic of Germany (F. R. Germany).

A radioisotope power source is described. The shielding around the device also serves as the heat sink for the cold side of the thermopile. The shielding is composed of a tapered cylindrical pot which fits inside an outer tapered cylinder. The thermocouple elements are bolted to the inner pot and a lid is bolted to both pot and cylinder. The whole shielding is constructed in such a manner that no hole passes through both inner and outer members. Various means of ensuring good thermal contact and allowing for expansion are explained and depicted. On the hot side of the thermocouple legs, the use of Ge-Si alloys permits a temperature as high as 1000°C. Pb-Te of Bi_2Tl_3-Sb_2Te_3 alloys can be used on the cold side. The hot and cold sides of the thermocouple legs can be connected by pigtails of silver wire. (CA)

27500 POLLUTION CONTROL THROUGH DIRECT ENERGY CONVERSION. Messerle, H. K.; George, D. W. (Univ. of Sydney). pp 104-110 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

The efficiency of electrical power generation plant has steadily improved from less than 5% in 1900 to about 30% for current nuclear plants and about 40% for the best fossil fuel fired power stations of today. No further increase is practically feasible using steam plant and the only effective way to raise efficiency and reduce thermal pollution is to look for alternative generation processes as discussed below. Direct energy conversion processes are shown to offer several possible solutions either on their own, as for example in the case of fuel cell systems, or alternatively in binary and topping cycles using a conventional steam plant as bottoming process. The MHD (Magneto-hydro-dynamic) electrical power generation process, as part of a topping cycle has reached an advanced stage of development and appears to be close to economic realization, and its status is discussed in relation to other possible approaches. (auth)

27501 NUCLEAR CONVERSION THERMIONIC. Schroff, A. M. (Thomson-CSF, Paris). Elec.-Electron. Mod.; No. R268, 8-15(Nov 1972). (In French).

The principle of thermionic converters is discussed. The different converter projects envisaged are reviewed together with the various stages in the development of the thermoelectric nuclear reactor program undertaken by the CEA. Particular attention is given to the structure of the electrodes and the different solutions envisaged for the converters intended for the reactor rods. (FR)

Facilities and Equipment

Refer also to abstract 28144.

27502 (CONF-721104-2) DESIGN TRENDS IN UNITED STATES UTILITY FEEDWATER HEATERS AND CONDENSERS. Coit, R. L. [nd]. 31p. NTIS.

From INCO power conference; Kyoto, Japan (28 Nov 1972).

The factors influencing the design of condenser systems are reviewed with particular reference to single pressure and multipressure systems. The growing size of steam turbine plants has led to increasing condenser sizes and examples of field erection of large units are given. High turbine exhaust steam velocities have resulted in condenser tube vibration problems. An analysis of the factors involved produces design guidelines for various tube materials and wall thicknesses. Condenser tube and tube sheet materials selection practice and corrosion performance are reviewed in detail and new trends are revealed. The characteristics of materials for feedwater heaters are discussed with reference to the type of steam generator and corrosion by water and steam. Current U. S. design practice is summarized. Particular emphasis is given, in both feedwater heaters and condensers, to the special requirements of nuclear systems. (auth)

27503 CREEP OF A STRAIGHT PIPE UNDER COMBINED BENDING AND INTERNAL PRESSURE. Spence, J. (Univ. of Strathclyde, Glasglow). Nucl. Eng. Des.; 24: No. 1, 88-104(1973).

Several analyses are presented for the isothermal creep behavior of a thin, constant thickness, circular cross-section cylindrical shell under the action of combined bending and internal pressure loading. Results are presented in a way that should be helpful for general pipework design. Previous analyses are summarized and discussed. (auth)

27504 ARARAT: COMPUTER CODE FOR THERMAL DESIGN OF COOLING TOWERS. Mesarovic, M. (Energoprojekt, Belgrade). Nucl. Eng. Des.; 24: No. 1, 57-70(1973).

A computer program is presented for thermal and hydraulic design of cooling towers. Options have been provided for the evaluation of cooling tower size and performance curves by applying a basic physical model of heat and mass transfer. The solution is conducted by multiple iteration, in which iteration loops are mutually inclusive. Both film and spray-filled cooling towers are considered with either induced or natural air circulation. Numerical solutions are presented to a number of natural draft cooling towers which serve present nuclear or conventional power plants. (auth)

Heat Transfer and Fluid Flow

Refer also to abstract 29473.

27505 (BRH-DEP-73-3, pp 299-307) TRENDS IN RADIATION PROTECTION: THE LITTLE THINGS THAT COUNT IN RADIATION SAFETY. McMaster, R. C. (Ohio State Univ., Columbus). Oct 1972.

In radiation safety and protection in industrial applications.

Accident experience related to personnel and equipment used in industrial radiography is related. Recommendations are made for the training and performance evaluation of such personnel, for improving operating procedures, and for developing more sophisticated radiation protection equipment. (LCL)

27506 (DP-1306) FORCED-CONVECTION SUBCOOLED CRITICAL HEAT FLUX. D_2O and H_2O Coolant with Aluminum and Stainless Steel Heaters. Knoebel, D. H.; Harris, S. D.; Crain, B. Jr.; Biderman, R. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). Feb 1973. Contract AT(07-2)-1. 54p. Dep. NTIS $3.00.

Forced-convection critical heat flux data and correlations are presented for both heavy water (D_2O) and light water (H_2O) coolant. The data were obtained with stainless steel and aluminum heaters which formed the inner wall of an annular channel. The critical heat flux for D_2O was determined to be 16% greater than that for H_2O at the same coolant velocity and subcooling. The critical heat

flux for aluminum heaters was determined to be at least 20% higher than that for stainless steel at the same coolant velocity and subcooling. A brief discussion of possible mechanisms for the difference is included. A combined improvement of 40% in the burnout heat flux is shown for aluminum heaters with D_2O coolant over that for stainless steel heaters with H_2O coolant. The results are for ideal heaters. When using the equations discussed in this report, factors must be applied for nonidealities such as the effect of spacer ribs. (auth)

27507 (ORNL-TM-3806) THERMAL TEST OF THE HEAT BLOCK SHIELD FOR THE ISOTOPE KILOWATT PROGRAM. Lackey, M. E. (Oak Ridge National Lab., Tenn.). Mar 1973. Contract W-7405-eng-26. 86p. Dep. NTIS $6.75.

In support of the Isotope Kilowatt Program an experimental determination was made of the temperature distribution in a full scale heat block-shield under various operating conditions including shipping and storage, a shipping accident, normal operation, and a loss-of-coolant accident. In addition to the temperature distribution tests, determination of the heat losses from a full scale operating system was made with 3.0 in. of fusible insulation around the heat block-shield. A heat loss of 7.2% of full power was obtained with the system operating at a heat block-shield surface temperature of 800°F and an air pressure of 0.1 psia, and 15.9% when operating at a heat block-shield surface temperature of 1100°F and an air pressure of 1.0 psia. (auth)

27508 (UNSW-1972-FMT-5) PRESSURE FLUCTUATIONS IN A VAPOUR–LIQUID MIXTURE FLOW. Davis, M. R. (New South Wales Univ., Kensington (Australia). School of Mechanical and Industrial Engineering). 1972. 29p. Dep. NTIS (U. S. Sales Only).

The results are presented of a series of measurements of unsteady wall pressure fluctuations for the upward flow of a vapor–liquid mixture of Freon in a circular pipe. The results show the strong attenuation of incident pressure disturbances by the mixture, the generation of pressure fluctuations by the turbulent two-phase mixture flow and the propagation of pressure disturbances associated with the flow in the direction of flow. The latter pressure disturbances appear to move at a velocity approximately 1.4 times that of the nominal average mixture velocity. (auth)

27509 TRANSIENT EFFECTS OF COMBINED FREE AND FORCED CONVECTION IN LIQUID-METAL HEAT TRANSFER. Kerlan, J. L. Columbia, MO; Univ. of Missouri (1972). 133p. University Microfilms Order No. 73-7047.

Thesis (Ph. D.).

The combined effects of forced and free convection during a flow transient are examined experimentally using eutectic NaK. The experimental model approximates parallel planes geometry, with uniform heating on both surfaces. A parametric study is conducted by individually varying the initial and final forced flow conditions, the rate of heat input, and the rate of flow decay (coastdown rate). Thermocouples located at several axial positions on the inside wall and at the duct centerline measure the transient temperatures. The transient-liquid flow rate is measured by inlet and outlet electromagnetic flowmeters. For a wide range of parameters, it is experimentally demonstrated that wall and coolant temperatures during the transient exceed those calculated for the initial forced flow steady state and the final free convective steady state. It is further demonstrated that the neglect of free convection in a transient analysis results in an overprediction of system temperatures. The magnitude of the temperature overshoot exhibited in the region of combined flow is presented as a dimensionless function of the experimental parameters. For a coastdown to a final free convective flow, the relative temperature overshoot decreases significantly with increasing heat flux, but increases with increasing coastdown rate. For a coastdown to steady state combined flow, the effect of the heat flux on the magnitude of the relative temperature overshoot is negligible; however, there still exists a significant difference in the time of occurrence of the maximum temperature. Although the data cannot be directly related to current fast-breeder-reactor designs because of differences in geometry, it is hoped that these data will be of aid in the evaluation of the importance of this phenomenon in reactors as well as providing a test for the accuracy of future analytical models. (Diss. Abstr. Int., B)

27510 DYNAMICS OF UNSTABLE FILM BOILING. Peterson, W. C.; Zaalouk, M. G. (North Carolina State Univ., Raleigh). Nucl. Eng. Des.; 24: No. 2, 180-187(1973).

A recently developed feedback system for the control of boiling heat transfer made possible the experimental investigation of process dynamics as well as static characteristics in all boiling regions. The region in which the process is normally unstable has now been studied experimentally for water boiling on a wire. A process transfer function previously developed analytically for this region gives quite good agreement between analytical and experimental transfer functions when heater end effects are taken into account. (auth)

27511 STEADY-STATE HEAT CONDUCTION IN SLABS AND CYLINDRICAL AND SPHERICAL SHELLS WITH NONUNIFORM HEAT GENERATION. Melese-d'Hospital, G. B. (Gulf General Atomic Inc., San Diego, CA); Wilkins, J. E. Jr. Nucl. Eng. Des., 24: No. 1, 71-87(Jan 1973).

A comparison is made between temperature drops in cylindrical and spherical shells and in slabs in the cases of uniform and non-uniform internal heat generation with the same total amount of heat. One boundary is assumed to be insulated; the rate of internal heat generation may be an arbitrary function of the radius. The (variational) ratio between the relative difference in temperature drops (in the non-uniform and uniform cases) and a (dimensionless) measure of the non-uniformity in heat generation is found to vary between narrow bounds which depend only upon the geometry. When the power density is better known, the bounds on the variational ratio get closer together. Similar derivations are made for the average temperature when one boundary is insulated or when both boundaries are at the same temperature. Kernels allowing the exact computation of temperatures of interest are listed in tables for various geometries and boundary conditions. (auth)

Materials Testing

Refer also to abstracts 27564, 27778, and 28282.

27512 (ANL-7973) PULSED EDDY-CURRENT TEST SYSTEM FOR HOT-CELL USE: MANUAL OF OPERATION. Renken, C. J.; Sather, A. (Argonne National Lab., Ill.). Nov 1972. Contract W-31-109-eng-38. 35p. Dep. NTIS $3.75.

The theory of pulsed eddy-current test methods is briefly discussed. The block diagram and circuit features of a system specifically designed for hot-cell operation are presented, together with the proper method of adjustment of the operating parameters for detection of fuel element jacket-tube defects and measurement of jacket-wall thickness. Details of the circuitry are briefly explained. (auth)

27513 (BRH-DEP-73-3, pp 96-136) INDUSTRIAL RADIATION UTILIZATION: AN OVERVIEW 1972. Socky, R. B. (General Electric Co., Bridgeport, CT). Oct 1972.

In radiation safety and protection in industrial applications.

Uses of x-ray and radioisotope sources in industry are reviewed briefly. Subjects mentioned include: development of radiographic equipment and methods, radiometric gages for industrial processes; radiation processing; specific civilian and military uses of radiation sources; and future developments including x-ray holography. (LCL)

27514 (BRH-DEP-73-3, pp 149-164) RADIATION SAFETY IN PRESSURE VESSEL INSPECTION. Graber, H. D. (Babcock and Wilcox Co., Barberton, OH). Oct 1972.

In radiation safety and protection in industrial applications.

The radiation safety aspects associated with radiographic inspection of nuclear power plant pressure vessel components having section thicknesses ranging from 100 mils to 18 in. are discussed. The Babcock and Wilcox Co. equipment and facilities for gamma and x-ray radiography are described. Safety precautions for handling the equipment, personnel safety training, and state and federal requirements governing safety in industrial radiography are discussed. The radiation hazards of inspecting contaminated components by nondestructive testing methods other than radiography are mentioned. (LCL)

27515 (BRH-DEP-73-3, pp 165-172) RADIATION SAFETY IN PIPELINE INSPECTION. Vancil, J. G. (Conam Inspection Inc., Tulsa, OK). Oct 1972.

In radiation safety and protection in industrial applications.

Radiation safety in the radiographic inspection of welds on cross-country pipelines is discussed in terms of shielding requirements, personnel training, radiation monitoring, and operating procedures. Pipeline radiography has been used in the US for 20 y with an enviable radiation safety record and has resulted in the removal of thousands of faulty welds which could have caused much damage and loss of life. (LCL)

27516 (BRH-DEP-73-3, pp 193-205) SAFE RADIATION PRACTICES IN TIRE INSPECTION. Beebe, M. (Westinghouse Electric Co., Pittsburgh). Oct 1972.

In radiation safety and protection in industrial applications.

The equipment and methods used for x-ray radiographic inspection of rubber vehicle tires are described. Two main parts of the tire inspection system are an image intensifier and closed circuit television. Information is included on an installation in a typical

factory environment, shielding equipment, inspection procedures, monitoring of the facility, and personnel monitoring equipment. (LCL)

27517 (BRH-DEP-73-3, pp 207-216) INSPECTION OF PARCELS FOR CONTRABAND USING IONIZING RADIATION. Bowman, J. H. (Dept. of Air Force, Springfield, VA). Oct 1972.

In radiation safety and protection in industrial applications.

The need for reducing contraband in the Air Force Postal and Courier Service is explained in terms of past experience with forbidden shipments of firearms,drugs, and stolen government property. Previously used method for curtailing such shipments are discussed. The design, operation, efficiency, radiation safety, and maintenance of the newly developed Dynafluor II device which is capable of x-ray fluoroscoping packages up to 100 lb in weight and 18 × 24 × 36 in. in size are described. 37 of these units have been installed throughout the world and are especially important in eliminating the shipment of explosive devices which endanger handling personnel and the aircraft used for transport. (LCL)

27518 (BRH-DEP-73-3, pp 217-232) RADIATION SAFETY IN BOMB DETECTION UTILIZING RADIATION TECHNIQUES. Staiger, J. W.; Wollan, R. O. (Univ. of Minnesota, Minneapolis). Oct 1972.

In radiation safety and protection in industrial applications.

Due to the increase in bombings and bomb threats in recent years, x-ray fluoroscopy and/or radiography methods are being used increasingly to evaluate the contents of suspicious packages. The importance of determining the radiation safety of such x-ray equipment and methods for handling the equipment are discussed. Radiation protection guidelines are listed which are applicable not only to individuals using x-ray equipment for evaluating suspected explosives, but also in the use of x-ray units for inspecting luggage, incoming parcels, customs inspections, and in industry for detecting glass or metal in food packages and containers. (LCL)

27519 (EURISOTOP-55(Vol.2), pp 999-1030) GAMMA-RAY RADIOGRAPHY TESTING OF PRESTRESSED CONCRETE. Settipani, A. (Societe AGS, Levallois, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A method for nondestructive inspection of prestressed concrete by gamma radiography is described. (TFD)

27520 (EURISOTOP-55(Vol.2), pp 1031-1034) NEW METHOD FOR LOCATING REINFORCEMENTS IN CONCRETE. Toyer, M. (Centre Scientifique et Technique du Batiment, Champs-sur-Marne, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A method for determining the position and size of reinforcements in concrete using x-ray radiography is described. (TFD)

27521 (EURISOTOP-55(Vol.2), pp 1035-1054) SLIDE RULE FOR GAMMAGRAPHIC TESTING OF CONCRETE. Gaggero, G.; Mongini-Tamagnini, C. (CCR–EURATOM, Ispra, Italy). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The exposure time required to obtain images of good quality varies as a function of irradiation conditions such as the type of source, its intensity, the source–film distance, the thickness of the shield, the thickness and type of filters, and the type of film. A computation procedure (theoretical model and programs for IBM 360/65) for construction of a flexible and accurate nomogram enabling personnel familiar with gamma radiography to read the value for the exposure time when the other variables are known is described. The procedure is general and can be used to construct fairly quickly nomograms for materials other than concrete and for any type of source. (TFD)

27522 (EURISOTOP-55(Vol.2), pp 1055-1067) GAMMA-RADIOMETRIC TESTING OF HORIZONTAL MORTAR CONNECTIONS IN PRECAST ELEMENT BUILDINGS. Moerch, E. (Danish Isotope Center, Copenhagen). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Prefabricated walls and pillars are usually mounted on leveling bolts and spaced 2 to 5 cm from the floor or previously mounted element. This space is then filled with mortar. Complete and homogeneous filling of these joints is essential to provide adequate load carrying capacity of the elements. A gamma radiographic method for inspecting the mortar joints is described. (TFD)

27523 (EURISOTOP-55(Vol.2), pp 1069-1090) USE OF RADIOISOTOPES IN THE CONSTRUCTION OF STEEL SPHERES. Jamar de Boisee, C. (S.A. Balteau, Beyne-Heusay, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Equipment and methods for gamma and x-ray radiographic inspection of welds in spherical steel reactor containment shells are described. The inspection is carried out at the shop during fabrication and at the site after the structure has been installed. (TFD)

27524 (SLA-73-224) CALIBRATION OF A COMPUTERIZED ULTRASONIC SYSTEM FOR ATJ-S GRAPHITE TESTING. Bishop, D. E. (Sandia Labs., Albuquerque, N. Mex.). Mar 1973. 34p. Dep. NTIS $3.75.

The effectiveness of a calibration method for a computerized ultrasonic system used at Sandia Laboratories to locate and size discontinuities in ATJ-S graphite billets is evaluated. The graphite calibration block with its artificial defects, the ultrasonic signals derived from the sized defects, and the computerized displays of these acquired signals are described. Repeatability and accuracy of the calibration system are demonstrated by a large number of data plots. While the signals from three sized defects at 1.0- and 2.0-in. depths are accurately recorded, signals from 3.0- and 3.5-in. depths show wider variations from known sizes and depths. Effects on accuracy of faster scan rates are also analyzed. The calibration method is deemed adequate in accuracy and repeatability for its current usage. (auth)

27525 NONDESTRUCTIVE TESTING OF REACTOR PRESSURE VESSEL MATERIALS IN THE PRODUCTION SHOP. Austel, W.; Oedinghofen, G.; Rudolph, A. Berg- Huettenmaenn. Monatsh.; 117: No. 5, 198-205(May 1972). (In German).

The nondestructive testing (NDT) techniques used by manufacturers for testing reactor pressure vessels are: magnetic particle surface crack testing, ultrasonic defect testing, and radiography of welded joints. Ultrasonic methods are also used to test the depth of welded cladding layers. The (German) standard methods of testing pressure vessel components are discussed and examples of some of the equipment, e.g., ultrasonic probes, frequencies, etc. are mentioned. The valuable contribution of NDT to reactor safety is stressed, and possible modifications in the NDT procedures adopted are examined in the light of subsequent repetition tests. (Metals Abstr.)

27526 REACTOR INSPECTION USES SOPHISTICATED NDT TECHNIQUES. Can. Welder Fabr.; 63: No. 12, 12(Dec 1972).

An automated weld inspection system for reactor pressure vessels handles inspection faster and more safely and thoroughly. It is designed to reach down into the "hot" reactor and ultrasonically inspect every inch of weld completely under computer control. Inspections can be done a portion at a time during scheduled shutdowns. The Tektran Immerscope ultrasonic test system pinpoints flaws of less than $\frac{1}{64}$ inch diameter. Only the probes enter the reactor, the instrument being in a control console. Seven probes are positioned by three telescoping manipulator arms and accurate positioning is assured by proximity sensors. A computer records all readings, analyses them during examination, and points out variances from earlier examinations. The computer has a manual override. ARIS gives 100 percent inspection of key welds at least once every ten years, as required for safety and licensing. (CA)

27527 ACOUSTIC EMISSION MEASUREMENTS ON REACTOR PRESSURE VESSEL STEEL. Palmer, I. G. (Central Electricity Research Labs., Leatherhead, Eng.). Mater. Sci. Eng.; 11: 227-236(1973).

Acoustic emission measurements have been made on laboratory specimens of reactor pressure vessel steel and the results correlated with crack tip yielding and crack extension. It has been shown that most of the emissions arise from plastic zone expansion, and that ductile crack growth is relatively quiet. The emission behavior is structure-sensitive, and is markedly affected by prestrain. The effects of annealing on the recovery of the emission behavior are described, together with the effects of oxidation and corrosion. (auth)

27528 FAST AND ACCURATE NON-DESTRUCTIVE TESTING SYSTEM FOR INSPECTION OF CANNING TUBES. Gundtoft, H. E.; Nielsen, N. (Danish Atomic Energy Commission, Risoe). Nondestr. Test.; 6: No. 1, 34-37(Feb 1973).

The development of an inspection bench for the nondestructive examination of canning tubes is described. The bench is original in that the internal diameter is calculated from exact measurement of the outer diameter and the wall thickness. The transducers for inspection and control are rotated around the tube. Thus all measurements are made externally to the tube. The result of these innovations is that nondestructive examination can be made in a single pass of the tube, and the assessment is more accurate, economical, and faster than that possible with existing techniques. (auth)

27529 COMPARATIVE YIELDS OF DIFFERENT CONVERTERS USED FOR THE PHOTOGRAPHIC DETECTION OF THERMAL NEUTRONS. Breynat, G. (CEN, Grenoble, France); Thomas, P.; Vu Hong Lac Bull. Inform. Sci. Tech. (Paris); No. 172, 55-64(Jul 1972). (In French).

The different tests effected with various neutron–photon converters for neutron diffraction experiments and neutron radiography are presented. The converter screens consist of mixtures of LiF and ZnS powders bound by different materials (araldite, polyurethane, silastene, Canada balsam). Monochromatic neutron fluxes were used for the neutron diffraction applications and polychromatic collimated neutron beams obtained from the thermalization of 14 MeV neutrons were used for the neutron radiography studies. (FR)

27530 NEUTRON RADIOGRAPHIC INSPECTION. Berger, H. (Argonne National Lab., IL); Iddings, F. A. Advan. Instrum.; 26: 642.1-642.10(1971).

From proceedings of the 26th annual ISA conference; Chicago, Illinois (4 Oct 1971).

See CONF-711003-(Pt. 2).

Radiography with neutrons offers a complementary method to radiographic inspection with gamma or x-rays. The inspection information is of the same type, that is, it is a film record of the radiation transmitted through the object. However, neutron radiography offers the capability to radiographically shadow low atomic number materials containing elements such as hydrogen, lithium, or boron even when present in heavy assemblies. In addition, one can often radiographically discriminate between elements that are very close together in the periodic table. Other advantages of radiography with neutrons include the capability to inspect highly radioactive material and to differentiate between different isotopes of the same element, such as cadmium and uranium. Techniques for neutron radiography are described, with emphasis on methods that could be used in industry. Utilization of the three available neutron sources will be discussed and illustrated. The nuclear reactor is the most widely used source and gives the best practical resolution. Accelerator and isotopic neutron sources offer portability and convenience for possible field applications. Examples of a number of applications, from inspections of adhesive-bonded metal assemblies to reactor fuel materials, are described. (auth)

Nuclear Explosions

27531 (BNWL-B-134) SURVEY OF EXPERT GEOLOGICAL OPINION ON FEASIBILITY OF PLOWSHARE STIMULATION OF NATURAL GEOTHERMAL SYSTEMS. Stewart, D. H.; Burnham, J. B. (Battelle Pacific Northwest Labs., Richland, Wash.). 20 Sep 1971. 20p. Dep. NTIS $3.00.

Twenty-two expert geologists from six countries with natural geothermal systems, (Hawaii, Iceland, Italy, Japan, New Zealand, and the U. S.), were interviewed for their opinions on the desirability of Plowshare stimulation of natural geothermal systems and whether Plowshare stimulation would be of interest to them with their particular system. A summary of the opinions showed that: all were concerned with the radioactivity produced by nuclear stimulation; all believed additional fracturing would improve steam and water recovery rates; re-injection of water into cavities seems desirable for more steam production; information from Plowshare experiments would be valuable to countries involved in geothermal energy development; and one expert would like a test in his geothermal field, while the others will wait until the technique has been developed. (LCL)

27532 (CONF-720614-9) RADIATION DOSES FROM HYPOTHETICAL EXPOSURES TO RULISON GAS. Barton, C. J.; Moore, R. E.; Hanna, S. R. (Oak Ridge National Lab., Tenn.). 1972. 48p. Dep. NTIS $4.50.

From 17th annual meeting of the Health Physics Society; Las Vegas, Nevada, USA (12 Jun 1972).

Production testing of the Rulison well, the second natural gas well developed by use of nuclear explosives, was completed in April 1971. The hypothetical situation that would have resulted if the dry, carbon dioxide-free gas originally present in the well had been withdrawn at a rate of 1 million ft^3/day and distributed by two gas companies to small communities in the area near the well was studied. Tritium and ^{85}Kr are the principal radionuclides present in the gas from the Rulison well. The average whole body dose from inhalation and skin absorption of tritium to members of the exposed public served by one of the gas transmission companies was estimated to be 0.6 mrem for the first year of gas use. The principal source of this hypothetical dose was exposure in the home to tritiated water vapor from cooking with unvented gas ranges. Use of unvented home heaters was not considered creditable. Whole body doses from exposure to tritiated water vapor dispersed in the atmosphere of the same communities averaged 0.1 millirem for the first year. Continuing use of gas at the same rate would reduce the average dose to 0.06 millirem in the second year and to 0.01 millirem in the third year as contaminated gas in the well is removed and the remaining gas is diluted with uncontaminated gas from the surrounding formation. Whole body doses from ^{85}Kr were estimated to be about 2% of the tritium whole body doses. (auth)

27533 (NERC-LV-539-9) RESULTS OF SAMPLING NATURAL GAS WELLS IN THE VICINITY OF PROJECT GASBUGGY. (National Environmental Research Center, Las Vegas, Nev. (USA)). Feb 1973. Contract AT(26-1)-539. 22p. Dep. NTIS $3.25.

Project Gasbuggy was the first experiment to investigate the feasibility of using a nuclear explosion to stimulate production of natural gas from a gas bearing formation. The detonation occurred on December 10, 1967, and on October 30 and 31, 1969, production from 28 gas wells located within five miles of Gasbuggy surface ground zero was resumed. Radiological sampling of natural gas was established on Trunk L and Lateral L-7 since these collection lines represented gas from all 28 wells. Natural gas samples were taken once every three to four weeks from November 5, 1969, to November 10, 1970. Samples were analyzed for radon-222, tritium, carbon-14, radiokryptons, and radioxenons. The samples were collected through particulate filters which were counted for gross alpha and gross beta activity and analyzed by gamma spectroscopy. The gas was collected in high pressure bottle for gas analysis. Only naturally occurring radon-222 was detected in the gas at concentrations from 12 to 59 pCi/l. (auth)

27534 (NVO-362-10) SURVEY REPORT OF AMCHITKA ISLAND IN-WATER INSTRUMENTATION SITES. Project Cannikin. (General Motors Corp., Santa Barbara, Calif. AC Electronics–Defense Research Labs.). Jun 1970. Contract AT(26-2)-362. 77p. (TR-70-53). Dep. NTIS $6.00.

The results of a survey of various in-water instrumentation sites on and around Amchitka Island are presented. The instruments were overpressuring measuring devices, bottom-motion tide gages, and the run-up gages on Amchitka. The sites were located and inspected, winches and cables inspected, and electronic components of the record trailer checked. The equipment, personnel, scheduling, and logistics support of the operation are discussed in detail. (LCL)

27535 (PNE-RB-18(Rev.1)) PROJECT RIO BLANCO DEFINITION PLAN. Volume III. Reentry-Related Detailed Tasks. (CER Geonuclear Corp., Las Vegas, Nev.). 24 Jan 1973. 114p. Dep. NTIS $7.75.

The Rio Blanco Event is an experiment for demonstrating the potential of commercial development of natural gas production stimulation using underground nuclear explosives. All of the Rio Blanco activities related to the chimney reentry and reservoir testing and evaluation are discussed in detail including preparations prior to reentry as well as during and following reentry. Information is included on site activities, reentry operations, production testing, safety, environmental protection, program management, public information aspects, radioecological studies, and program scheduling. (LCL)

27536 (PNE-RB-39) RIO BLANCO. Hydrologic Testing Through January 30, 1973. Knutson, C. F. (CER Geonuclear Corp., Las Vegas, Nev.). 1973. 106p. Dep. NTIS $7.50.

The hydrologic testing to January 19, 1973 in the Rio Blanco emplacement area can be considered in three phases: drilling and completion testing of RB-D-01, summer and fall 1972 testing in RB-D-01, and winter 1972 to 1973 testing in RB-D-01 and RB-S-03. Test results from each of these phases are presented and discussed. Detailed data and analyses are given. Based on the results of the testing to date and discussions with USGS personnel where further hydrologic testing was recommended, an additional program has been designed. The plans for this program are also discussed. (auth)

27537 (PNE-RB-40) PROJECT RIO BLANCO. Emplacement Well, RB-E-01 as Built Report. (CER Geonuclear Corp., Las Vegas, Nev.). 22 Jun 1972. 173p. Dep. NTIS $10.75.

The Rio Blanco well, RB-E-01, was drilled to fulfill certain unit requirements, to extend some leases, and to obtain additional hydrologic and geologic data at the proposed Rio Blanco site. Detailed information is presented on the construction of the well, i.e. drilling and cementing, and the final "as built" conditions of the well. (LCL)

27538 PLOWSHARE'S DEATH RATTLE AT RIO BLANCO. Chedd, G. New Sci.; 57: No. 836, 544-545(8 Mar 1973).

Project Rio Blanco is the third in a series of Plowshare tests

designed to explore the practicability of releasing natural gas from low-permeability reservoirs with the aid of nuclear explosives. Although there is an alleged energy crisis in the US the public is not enthusiastic about the project. Nuclear bombs produce radioisotopes and the gas which first flows into the cracked rock produced by the explosions will be heavily contaminated with radioactivity. The methods envisaged to reduce the radioactive contaminants from the gas are considered and the even greater difficulties which will be encountered should nuclear stimulation ever be employed on a production scale outlined. The suggestion is made that gas stimulation is the result of AEC's looking around in some desperation for something technologically and politically feasible to do with its bombs and expertise. (UK)

27539 SEISMIC MAGNITUDES OF UNDERGROUND NUCLEAR EXPLOSIONS. Basham, P. W.; Horner, R. B. (Dept. of Energy, Mines and Resources, Ottawa). Bull. Seismol. Soc. Amer.; 63: No. 1, 105-131(Feb 1973).

Using an M_s computational procedure that minimizes path-propagation effects, and with M_s values found to be empirically independent of test site and detonation medium among consolidated rock explosions, available yield information is employed to illustrate that the seismic scaling of explosions in realistic detonation environments produces teleseismic Rayleigh-wave displacements proportional to the 1.2-power of yield over the range from low yields to greater than three megatons. M_s values independent of network, path, and site can be employed to estimate unknown yields at uncalibrated test sites to within average errors judged to be about 20%. P-wave magnitudes, in the form of a calibrated teleseismic measure of short-period P-wave displacements, show a theoretically supported dependence of displacement on the 1.1-power of yield over the range from 6 kt to 1 mt. Studied explosions separate into two categories: the Nevada Test Site granite explosions, LONG SHOT, the Sahara February 1965 explosion and (by empirical inference) Novaya Zemlya and Eastern Kazakh explosions exhibit P-wave displacements about a factor of 3 greater than explosions of the same yield in tuff, rhyolite, and shale. P-wave magnitudes of explosions are subject to such a diversity of source, propagation, and measurement phenomena that any estimation of unknown yields without a closely controlled site and network calibration can be subject to large errors. (auth)

27540 MULTIPOLE REPRESENTATION OF EARTHQUAKE SOURCE MECHANISMS. Yeatts, F. R. (Colorado School of Mines, Golden). Bull. Seismol. Soc. Amer.; 63: No. 1, 211-225 (Feb 1973).

The static displacement field in an elastic half-space caused by a general, finite disturbance is derived in the form of an infinite series (multipole) expansion. The relationship between this theory and dislocation theory is discussed with the aid of examples. A multipole source model is derived for the strain-step field associated with the nuclear blast HANDLEY set off at the Nevada Test Site on March 26, 1970. The results suggest that there was significant fault movement associated with the detonation. (auth)

27541 OBSERVED EFFECTS OF TOPOGRAPHY ON GROUND MOTION. Davis, L. L.; West, L. R. (Environmental Research Corp., Las Vegas, NV). Bull. Seismol. Soc. Amer.; 63: No. 1, 283-298(Feb 1973).

Field experiments were performed to obtain data needed for studying the effects of topography on seismic motion. L-7 instruments deployed at the crest and base of Kagel Mountain and Josephine Peak, California, recorded several aftershocks of the February 9, 1971, San Fernando earthquake. L-7 instruments deployed at the crest, middle, and base of Butler Mountain near Tonopah, Nevada, recorded the seismic signal generated by the cavity collapse following the Nevada Test Site detonation, ALGODONES. Frequency-dependent amplification of the motion at the crest relative to the motion at the base was observed at all three mountains. Factors as large as 30 in the frequency domain were seen at Kagel Mountain with lesser amounts at the other two locations. The three mountains are similar in shape, but different in size. The effect of shape is not clear. The smallest mountain amplified the motion in a narrow range of periods (peaking around 0.3 to 0.5 sec), the medium-size mountain showed amplification over a slightly broader range (peaking at periods of 0.4 to 0.5 sec), whereas the largest mountain showed less amplification, but it occurred over a broader range of periods. Effects in the time domain are generally comparable to, or less than, the effects in the frequency domain. The ratios of peak amplitudes (crest to base) are usually less than the spectral ratios. It is concluded that topography plays a significant role and is an important consideration in determining the seismic motion that a particular site receives. (auth)

27542 SOME INTERESTING CENTRAL ASIAN EVENTS ON THE M_s:m_b DIAGRAM. Landers, T. (Massachusetts Inst. of Tech., Lexington). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 329-339(Dec 1972).

Events from two small regions in Central Asia having nearly equal m_b values were found to have a wide range of M_s values. One event from Tibet and one from South-eastern Kazakh, USSR, showed M_s: m_b ratios typical of explosions. Several other events showed borderline ratios. All of the events analyzed are classified as shallow focus earthquakes by NOS (i.e., their focal depths are all listed at greater than 20 km in the Preliminary Determination of Epicenter catalogue). The Tibetan events were earthquakes. The Kazakh event data exhibit a short-period complexity, in addition to an M_s: m_b ratio typical of an explosion. However, it cannot be classified as such because its short-period record also contains an apparent depth phase at a time lag corresponding to a focal depth of 22 km. The possibilities of the "depth phase" being the result of multiple explosions or of the short-period complexity being the result of unusual source parameters cannot be differentiated with the available data. Discrimination of the event is further complicated by the fact that its Rayleigh wave was swamped by the surface wave of much larger event from the Tonga Islands Region. The interfering event problem is not too serious here because the short period continental Rayleigh wave from the Kazakh event rides atop the long period oceanic surface wave from the Tonga event in such a way that the effects of each are visually separable. (auth)

27543 INITIAL DISCRIMINATION RESULTS FROM THE NORWEGIAN SEISMIC ARRAY. Filson, J.; Bungum, H. (Massachusetts Inst. of Tech., Cambridge). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 315-328(Dec 1972).

A study has been made of the capability of the Norwegian Seismic Array to discriminate between earthquakes and underground explosions occurring in central Asia and western Russia. The ratio of surface to body wave magnitudes (M_s: m_b) has been used exclusively, the chief application of the array being in the detection and measurement of low-amplitude surface waves. Beam-forming and matched filtering were the signal enhancement techniques applied. Of 34 events in central Asia studied, 10 were identified as explosions, 22 earthquakes, and two were unidentifiable because of high, long period background noise. Five events in aseismic western Russia, all presumed to be explosions, showed wide variation in M_s: m_b, two of these measurements being close to the earthquake population of central Asia. The M_s: m_b measurements of central Asia explosions made in this and another study are compared with measurements of Nevada explosions. For a given M_b the latter consistently have higher M_s values. The possible causes of this are discussed and, depending on the cause, the array seems capable of detecting surface waves from an explosion of 4 to 16 kt yield at 40° distance in central Asia. Strong seismic noise variations in Norway make this long-period capability time dependent. (auth)

27544 RESULTS FROM THE HIGH-GAIN LONG-PERIOD SEISMOGRAPH EXPERIMENT. Savino, J. M.; Murphy, A. J.; Rynn, J. M. W.; Tatham, R.; Sykes, L. R.; Choy, G. L.; McCamy, K. (Columbia Univ., Palisades, NY). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 179-203(Dec 1972).

Eight high-gain long-period seismography systems with peak analogue recording magnifications of up to 150,000 have been installed in different regions of the world. The particular passbands of these instruments are nearly optimum, especially the vertical components, in the sense that Earth noise is approximately prewhitened by the instrumental response. A minimum in the level of Earth noise at periods near 30 s is observed on noise spectra from all of these sites, which differ greatly in geographical location, geologic setting, and depth of overburden. At many of these stations surface waves with periods between 20 and 40 s are often observed from shallow focus earthquakes with magnitudes as low as $m_b = 4.1$ at epicentral distances of 20° to 25°. Various filtering techniques have been applied to the data digitally recorded at these stations especially polarization filtering of surface waves, and have enhanced the signal to noise ratio for surface waves from some earthquakes by as much as 6 db. These techniques should further lower the surface-wave detection thresholds. (auth)

27545 Q AND SEISMIC DISCRIMINATION. Solomon, S. C. (Massachusetts Inst. of Tech., Cambridge). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 163-177(Dec 1972).

The vagaries of seismic attenuation, or Q, in the Earth render uncertain the estimates of many seismic source parameters. In particular, the discrimination of waves produced by earthquakes from those of explosions, if the waves have travelled dissimilar paths, and the characterization of a seismic source from the seismic-wave amplitude spectrum require concern for the spatial and frequency dependence of Q. Surface-wave amplitudes are most affected by attenuation at periods long enough (30 s and greater) so that much of the energy propagates in the low-Q asthenosphere, and at periods short enough (less than 15 s) so that near-surface structure is important. Thus the standard surface-

wave magnitude is largely insensitive to anelastic losses, though for the surface-wave spectral shape to be diagnostic of source depth, such losses must be considered. The amplitudes of body waves that have penetrated the low-Q asthenosphere reflect the extreme variations of Q within that zone. Seismic discrimination criteria based on the body-wave magnitude should be restricted to comparison of events from the same tectonic province. Estimates of such source properties as source dimension and fractional stress drop depend critically on properly accounting for the frequency dependence of Q. (auth)

27546 TELESEISMIC AND EARTH NOISE MONITORING WITH THE BLOCK–MOORE QUARTZ ACCELEROMETER. Whorf, T. (Univ. of California, San Diego, La Jolla). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 205-238(Dec 1972).

A study was made of some recent data recorded through the seismic channel of a broad-band vertical quartz accelerometer operating near San Diego, California. Such a study provided information concerning instrument capabilities for detection of surface waves from small teleseisms and Earth noise levels, including temporal variations. The data suggest that detection thresholds of the same order as those of the high-gain long-period installation at Ogdensburg are attainable as a surface site with the quartz instrument. Indications are that an approximate 10 db gain in surface wave detection would in general provide high probability of detection (c. 0.85) of $m_b = 4$ earthquakes at distances of ~40°. In addition, results suggest that noise levels in the range 5 to 200 s recorded at this site with the accelerometer are comparable to those obtained at other surface sites, and somewhat higher than those obtained at depth for periods longer than about 30 s. A study of a number of events recorded has demonstrated that nearly half (~47%) of all events reported by the NOAA PDE program were detected. (auth)

27547 REVIEW OF TIDAL, EARTH NORMAL MODE, AND SEISMIC DATA OBTAINED WITH QUARTZ TORSION ACCELEROMETERS. Block, B.; Dratler, J. (Univ. of California, San Diego, La Jolla). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 239-269(Dec 1972).

A review of broad-band data obtained with quartz torsion accelerometers is presented. Special emphasis is made on the Earth normal mode and seismic frequency regions. Comparison with more conventional instruments is provided where possible. (auth)

27548 DETECTION THRESHOLD OF THE LASA/SAAC SYSTEM. Dean, W. C. (Teledyne, Inc., Alexandria, VA). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 271-278(Dec 1972).

An estimate of the detection threshold of a seismic observatory can be obtained from recurrence curves. Since small events are expected to occur more frequently than larger events, a plot of the number of events detected at LASA versus their magnitude over a long interval of time will fail to increase as magnitude decreases when the detection threshold is reached and small events are lost in the noise. At LASA the 90% discrete threshold occurs at magnitude 3.9, and the 90% cumulative threshold occurs at magnitude 3.7 for events within 30° to 85° of LASA. The detection rate varies inversely with the noise level and is somewhat lower in the late autumn than it is during the summer when the noise is lower. (auth)

27549 LONG-PERIOD SIGNAL PROCESSING RESULTS FOR LASA, NORSAR, AND ALPA. Capon, J. (Massachusetts Inst. of Tech., Lexington). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 279-296(Dec 1972).

A detailed discussion is given of various signal processing techniques for enhancing the signal-to-noise ratio of the Rayleigh wave of an event. These methods are evaluated on the basis of their performance using LASA data, as well as complexity of implementation. The problem of detecting one Rayleigh wave in the presence of the code of another larger Rayleigh wave is considered. A detection method is proposed and its performance is evaluated and shown to be quite impressive. Analysis of long-period noise at NORSAR was performed and the results are presented. In addition, the results of a simultaneous analysis of long-period noise at ALPA and LASA are given. (auth)

27550 PRELIMINARY EVALUATION OF ALPA. Harley, T. W.; Helting, L. N. (Texas Instruments Inc., Alexandria, VA). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 297-313(Dec 1972).

An initial estimate of the utility of the Alaskan Long-Period Array, based on 1970 to 1971 data, was made. Areas of investigation which relate to signal enhancement include several potential means of array data processing, selection of appropriate bandpass filters, and the efficacy of various approaches to the matched-filtering of surface waves. Both direct and indirect estimates of the detectability of long-period surface waves have been made. Data reflecting the performance of M_s, AR, and AL discrimination parameters are included. The results presented were obtained with the nine sites in the southern half of the array which were available during the time period covered. (auth)

27551 TECTONIC STRAIN RELEASE BY UNDERGROUND NUCLEAR EXPLOSIONS AND ITS EFFECT ON SEISMIC DISCRIMINATION. Toksoez, M. N.; Kehrer, H. H. (Massachusetts Inst. of Tech., Cambridge). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 141-161(Dec 1972).

The analysis of surface waves from a large number of underground nuclear explosions reinforces the hypothesis of tectonic strain release. Such strain release is dependent on rock type and ambient stress levels. In harder media, such as granite, strain release is considerably greater than in soft media such as loose alluvium and salt. In the case of three events for which the tectonic component exceeded that of the explosion itself, the effect on the $M_s - m_b$ discriminant due to the added surface wave energy was not noticeable. This was probably due to the averaging of magnitude over all azimuths. A decaying pulse-type source-time function is consistent with surface wave amplitude spectra and can explain the long-period/short-period spectra ratio. (auth)

27552 SCALING LAW OF EARTHQUAKE SOURCE TIME-FUNCTION. Aki, K. (Massachusetts Inst. of Tech., Cambridge). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 3-25(Dec 1972).

Although further evidence has been found supporting the scaling law for the far-field seismic spectrum based upon the ω-square model (Aki) for earthquakes with $M_s > 6$ and for periods $T > .10$ s recent observations unequivocally require the modification of the above law for periods $T < 10$ s. Unfortunately, the presently available data are not sufficient for a unique revision of the scaling law. Two alternatives are proposed and their implications and consequences discussed. In either case it is concluded that a large earthquake and a small one are substantially different. One interesting feature of the ω-square model appears to be unaffected by the required revision; that is, the spectral density of the fault-slip time function for periods $T < 5$ s takes the same absolute value, independent of magnitude, for earthquakes greater than $M_s = 6.5$. This result has important consequences in earthquake engineering because the seismic motion in the vicinity of an earthquake fault will scale as the fault-slip motion. (auth)

27553 SOURCE PARAMETERS OF NUCLEAR EXPLOSIONS MILROW AND LONGSHOT FROM TELESEISMIC P WAVES. King, C. Y.; Bakun, W. H.; Murdock, J. N. (National Oceanic and Atmospheric Administration, San Francisco). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 37-44(Dec 1972).

Spectral ratios in the frequency range from 0.5 Hz to 3.0 Hz between the underground nuclear explosions MILROW and LONGSHOT have been computed from teleseismic P waves recorded at seven Long Range Science Measurement (LRSM) stations. These ratios are interpreted on the basis of a theoretical model to estimate source parameters for the two explosions. The adopted model has a spherical source exerting a pressure, which is a step function of time, to the surrounding elastic medium. The results indicate that MILROW had a source radius of $\frac{3}{4}$ km and LONGSHOT $\frac{1}{2}$ km. The source pressure of MILROW estimated to be about twice as large as that of LONGSHOT. Spectral modulation, presumably caused by the pP waves, indicates a pP-P time interval of 0.86 s for MILROW and 0.55 s for LONGSHOT. These intervals imply an apparent average overburden P-wave velocity of 2.9 km/s for MILROW and 2.6 km/s for LONGSHOT. These velocities are significantly lower than the values obtained from on-site measurements, probably due mainly to a difference between the P-wave and the pP-wave velocities in the source region. The pP-wave amplitudes are apparently 0.6 times the corresponding P-wave amplitudes. The results support the suggestions that the pP interference is partly responsible for the low excitation of long-period P waves by underground nuclear explosions and that the resultant spectral modulation may be utilized for estimating detonation depths and as a diagnostic aid for explosion identification. (auth)

27554 SEISMIC SOURCE DESCRIPTIONS OF UNDERGROUND EXPLOSIONS AND A DEPTH DISCRIMINATE. Helmberger, D. V.; Harkrider, D. G. (California Inst. of Tech., Pasadena). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 45-66(Dec 1972).

Synthetic seismograms of both body waves and Rayleigh waves were used to determine the seismic energy field of a few large contained underground explosions and a number of possible source descriptions investigated. A reduced displacement potential of the form, $\varphi(t) = \phi_0 t^\xi \exp(-\eta t)$, fits the long- and short-period data. The source parameters appropriate for the Boxcar event are $\xi = 0.5$ and $\eta = 0.15$. Synthetic PL and Rayleigh waves are compared with observations from a number of different size events to determine the dependence of η on yield. The amplitude of the long period synthetic body wave responses at ranges greater than about 12° increases rapidly as the source depth is increased. Thus the difference in spectra properties of explosions and earthquakes can

be largely explained by the depth effect. The theoretical ratio SP/LP, that is the short period divided by the long-period amplitude, is computed from 12 to 25° for the Johnson upper mantle model and the Boxcar source. A study of an earthquake which cannot be distinguished from an explosion using the m_b vs. M_s criterion is investigated by the SP/LP discriminate. (auth)

27555 SOURCE CHARACTERISTICS OF EARTHQUAKES, EXPLOSIONS, AND AFTEREVENTS. McEvilly, T. V.; Peppin, W. A. (Univ. of California, Berkeley). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 67-82(Dec 1972).

Broad-band seismic data available on the magnetic tape library at Berkeley were used in a study comparing P_n and Rayleigh waves from earthquakes, explosions and explosion afterevents, both collapse and earthquake types. Eighty-one events equidistant from Berkeley at 500 to 550 km provided the data for wave amplitude and spectra comparisons. Explosions exhibit characteristic low Rayleigh wave (12s period) generation, for given P_n amplitude, relative to earthquakes, as well as explosion afterevents. This discriminant, for events recorded at Berkeley is well developed down to local magnitude M_L 4.0 or less ($m_b^1 \times 3.6$) and shows no indication of convergence, although scatter increases, for smaller events. Rayleigh wave spectra for explosions and collapses are quite similar, the similarity continuing up to frequencies of 0.5 Hz for proximate events, but they differ significantly from spectra of shallow earthquakes in the same source region. This implies the explosions, including large ones with appreciable surface faulting, Love wave generation, and aftershock sequences, are sources with small time and space dimensions, relative to shallow earthquakes at the same site. Extensive fault displacements near large explosions are proposed as passive medium response to strong shaking, and Love wave generation with Rayleigh wave asymmetry is suggested to occur through processes acting in the relatively small high stress explosive source region. (auth)

27556 SOURCE TIME FUNCTIONS AND SPECTRA FOR UNDERGROUND NUCLEAR EXPLOSIONS. von Seggern, D.; Blandford, R. (Teledyne, Inc., Alexandria, VA). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 83-97(Dec 1972).

The model of Haskell (J. Geophys. Res. 72: 2583 (1967)) for explosion source time functions and spectra fails to satisfy data in the short-period band recorded teleseismically from the three Amchitka Island underground nuclear tests LONG SHOT, MILROW, and CANNIKIN, but a more recent model due to Mueller and Murphy (Bull. Seis. Soc. Amer. 61: 1675 (1971)) satisfies the data quite well. The difference in the two models is basically in the fall-off at high frequencies. A simple revision of Haskell's model, however, produced waveforms and spectra nearly identical to those from Mueller and Murphy's model. This revision requires velocity waveforms to have a rise time of extremely short duration at the elastic boundary, a premise validated by actual near-field measurements. Waveforms are derived from the revised Haskell model and the Mueller and Murphy model and illustrated for pressure at the elastic boundary, reduced displacement potential at the elastic boundary, and far-field displacement. Corresponding spectra are derived and illustrated. (auth)

27557 OBSERVATIONS OF pP IN THE SHORT-PERIOD PHASES OF NTS EXPLOSIONS RECORDED AT NORWAY. Frasier, C. W. (Massachusetts Inst. of Tech., Lexington). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 99-109(Dec 1972).

P waves from 11 Nevada Test Site explosions, recorded digitally at Norway, are examined for p^P phases. Rather than using spectral techniques, the combined effect of the short-period displacement response of the seismometers and Earth attenuation for $t^* = 0.25$ is deconvolved in the time domain from the observed P waves. Each reduced seismogram is interpreted directly as the effective far-field displacement source for each explosion. The P and p^P phases are sharpened by the deconvolution so that $pP-P$ times are more easily distinguished. These delay times are combined in a computer with another set of delay times using spectra methods. Average overburden compressional velocities from the combined set of data show an increase from 1.5 to 2.5 km/s from depths of 600 to 1400 m at Pahute Mesa. Data from Yucca Flat and Hot Creek Valley are not complete enough to detect a trend. Calculated velocities are most likely lower than expected due to the fracturing of the overburden section by the explosions. The reduced seismograms show that pP is often smaller in amplitude than P and less rich in high frequencies. A later pulse, possibly due to the slapdown of surface rocks after the spall, was observed to have the same polarity as P. Such effects require more complicated explosion source models than currently used for short-period data. (auth)

27558 USE OF LP SURFACE WAVES FOR SOURCE CHARACTERIZATION. Tsai, Y. B. (Texas Instruments Inc., Alexandria, VA). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 111-130(Dec 1972).

The complex spectrum technique was found to provide an effective means for removing undesirable modulations of surface wave spectra caused by interference of either multiple sources or multipath propagation. This technique has greatly enhanced the utility of surface wave spectra for characterization of seismic sources. An empirical analysis of surface wave spectra on a regional basis is made on seismic events in the Arctic Ocean and the Eurasian Continent. The results indicate that: the spectral shapes of Rayleigh waves often are similar among events in the same epicentral area but vary substantially from one epicentral area to another; a great majority of earthquakes can be differentiated from underground nuclear explosions based on spectral shapes of Rayleigh waves; and spectra shapes of Love waves do not vary as much as Rayleigh waves from one epicentral area to another. A method for systematically finding the source mechanism and focal depth of an earthquake using the observed and theoretical surface wave spectra is devised and tested. The results from tests of the method on several earthquakes are consistent with other independent evidence. (auth)

27559 OBSERVATIONS OF SHORT-PERIOD SEISMIC ENERGY FROM EARTHQUAKES AND INFERENCES ABOUT THE SEISMIC SOURCE. Davies, D.; Ziolkowski, A. (Massachusetts Inst. of Tech., Lexington). Geophys. J. Roy. Astron. Soc.; 31: No. 1-3, 131-139(Dec 1972).

The short-period energy radiation from earthquakes as recorded at high quality seismic stations is considered. Particular attention is paid to the profile of energy release as a function of time. Mantle phases such as P are often unsuitable for this purpose because of lateral heterogeneity but core reflected phases are frequently much simpler. By comparison with events of known character the estimation of the duration of short-period energy radiation from earthquakes is possible. Under certain assumptions, this gives a maximum dimension D_S over which there is significant short-period energy generated. Six earthquakes with D_S as small as 2 km and as large as 50 km are described. It seems possible with a suitable array to examine the energy release pattern of extended earthquakes in some detail. (auth)

27560 THERMAL EFFECTS OF UNDERGROUND NUCLEAR EXPLOSIONS. Taylor, R. W. (Univ. of California, Livermore). Nucl. Technol.; 18: No. 2, 185-193(May 1973).

Most of the energy of an underground nuclear explosion is deposited near the site of the explosion as heat. The heat remains localized for a long time because of the low thermal conductivity of rock. This heat plays a role in Plowshare applications by generating steam and, in the case of carbonate-bearing rocks, CO_2. Applications to stimulate natural-gas production are complicated by the production of tritiated steam and CO_2. The temperature of the rubble in the chimney fixes the steam partial pressure in the produced gas. Increasing chimney temperature, and thus steam pressure, is expected with increasing depth of explosion and also with decreasing space between detonations, in the case of multiple explosions. Laboratory experiments on shales that are mostly fine grain mixtures of quartz and carbonate show that CO_2 is released at temperatures as low as 500°C, even under a CO_2 pressure of 50 atm. In the future, the release of large amounts of CO_2 may be used to advantage in secondary oil recovery and in the recovery of heavy crude oils, because of the great reduction in viscosity that results as CO_2 dissolves in these oils. The nuclear chimney, with its large void volume, large surface area for catalysis, and high temperatures, is a potential high-pressure vessel for chemical reaction. (auth)

27561 ECONOMIC DATA CONCERNING THE STIMULATION OF GAS DEPOSITS BY NUCLEAR EXPLOSIONS. Emmanuel, H. (CEA, Paris). Energ. Nucl. (Paris); 14: No. 6, 456-460(Nov 1972). (In French).

The American Plowshare program concerning the stimulation of natural gas deposits using contained nuclear explosions is described. The policy of the American government tends to diminish the financial participation of the state and encourages the participation of private industry. The Gasbuggy and Rulison explosions produced a significant increase in the production of natural gas with a negligible formation of radioactive gas. The costs of these projects were evaluated together with those of the future Rio Blanco and Wagon Wheel projects. An economic analysis of the industrial exploitation of a well (production, revenue, taxes and charges) was effected together with studies of government revenues and the cost of substituting stimulated gas for imported petroleum or liquefied natural gas. (FR)

Protective Structures and Equipment

Refer also to abstract 27505.

27562 (EURISOTOP-55(Vol.2), pp 1101-1112) SERIES OF TESTS ON LARGE TEST PIECES TO DETERMINE THE OPTIMUM BARYTES CONCRETE SHIELDING DURING CONSTRUCTION OF THE HOT CELL INSTALLATION AT THE SEIBERSDORF REACTOR CENTRE. Huber, G.; Patek, P. (Oesterreichische Studiengesellschaft fuer Atomenergie mbH, Vienna). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The shielding for the cells at the medium activity laboratories consists of 1 m of barytes concrete cast between steel shells. The greatest difficulties are presented by many hundreds of penetrations, at the bottom of which experience has shown cavities to form during concreting, thereby reducing the effectiveness of the biological shield. In order to determine the optimum grain structure, W/Z factor, vibrating times, tipping heights, charge sizes, etc., d series of tests was performed with test pieces of various shapes, with the initial aim of attaining the required density d > 3.5, and subsequently of filling up the above-mentioned spaces under the penetrations. The radiometric method employed to inspect the test pieces during construction is described. (TFD)

27563 (EURISOTOP-55(Vol.2), pp 1137-1140) INVESTIGATION ON CONCRETE WITH LOW-INTRINSIC RADIOACTIVITY. de Meijer, R. J. (State Univ., Utrecht). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The experimental technique used in the search for materials to construct a shielding concrete with low-intrinsic radioactivity is reported. The investigation showed that gamma rays produced in concrete components are mainly due to the decay of ^{40}K and ^{208}Tl. Concrete consisting of silver-sand, marble and white Aalborg cement had the lowest natural radioactivity. A disadvantage, however, is its high cost (8 times that of normal concrete); in addition some processing problems occurred. Therefore, concrete made from silver-sand, washed pebbles from Waubach in the Netherlands and Dyckerhoff Sulfadur cement was preferred for shielding for the new nuclear physics laboratory in Utrecht. This concrete reduced the background radiation by a factor of 10 and is less expensive (2 times that of normal concrete). (TFD)

Safety Engineering

Refer also to abstracts 27514–27516.

27564 (BRH-DEP-73-3, pp 137-147) RADIATION SAFETY IN AIRLINE MAINTENANCE. Weldon, W. J. (American Airlines Maintenance and Engineering Center, Tulsa, OK). Oct 1972.

In radiation safety and protection in industrial applications.

Airline maintenance equipment which uses radiation sources includes electron beam welding machines and radiographic equipment for structural material inspection. The radiation safety precautions and safety requirements for personnel working with such equipment are discussed. (LCL)

27565 (BRH-DEP-73-3, pp 233-237) IMPLEMENTATION OF THE OCCUPATION HEALTH AND SAFETY ACT OF 1970. O'Neill, J. P. (Dept. of Labor, Washington, DC). Oct 1972.

In radiation safety and protection in industrial applications.

Implementation of the Occupational Safety and Health Act which became effective on May 29, 1971 requires the establishment of health and safety standards. The difficulties in developing such standards are discussed and include lack of useful data concerning occupational injuries and disease, lack of uniformity in methods for measuring such data, knowledge of man-environment relationships, and the need to coordinate information in a variety of disciplines in order to evaluate health and safety hazards. (LCL)

Vacuum Engineering

27566 UHV OPENING TECHNIQUE FOR ANALYZING METAL CERAMIC VACUUM TUBES. Grady, B. L Jr. (General Electric Co., Louisville, KY). J. Vac. Sci. Technol.; 10: No. 1, 208-211 (1973).

A method whereby a metal ceramic magnetron tube can be opened on an uhv system and then operated for gas analysis with a mass spectrometer is described. A video tape recorder is employed to record gas evolution during both the tube opening and operation, so that instantaneous gas release can be observed. Vacuum integrity of the tube on the system is kept intact at all times. Preparation of a tube for opening is discussed in detail. Gases evolved due to the opening device piercing the metal tube envelope are also discussed. (auth)

27567 ACCESS TO UNCOMBINED TITANIUM THROUGH AN INHIBITING FILM IN SUBLIMATION PUMPING OF DEUTERIUM. Steinberg, R.; Alger, D. L. (Lewis Research Center, Cleveland). J. Vac. Sci. Technol.; 10: No. 1, 246-250(1973).

In principle, titanium bulk sublimator pumping should be ideal for removing large quantities of deuterium from a vacuum system. In practice, much of the deposited titanium remains uncombined and is wasted. It is demonstrated, through a series of experiments, that it is possible (by the addition of a thin layer of titanium to an apparently occluded surface) to gain access to previously deposited sublayers of uncombined titanium in spite of the presence of an inhibiting film (such as an oxide) on the surface. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

Refer also to abstract 29804.

Minerals and Ores

Refer also to abstracts 27309, 27685, and 28117.

27568 (INIS-mf-466) AERIAL RADIOMETRIC PROSPECTING. Marinkeff, K.; Coco, A. L. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1972. 15p. (In Spanish). INIS.

General information is presented on aerial radiometric prospecting for orientation of the nonspecialized reader in distinct technical aspects of this activity. Fundamentals are given on which the procedure for the discovery of radioactive deposits is based; the characteristics of natural radioactivity are given, such as observed in nature; and then the instruments are described. Reference is made to the types of aircraft required and to the operating technique employed, and also to other practical applications of aerial gamma measurement. Work carried out in the country is briefly mentioned and some idea is provided concerning the performance and costs that are hoped to be feasible. (tr-auth)

27569 (REG/G-3-5(2-73)) GUIDE TO THE CONTENTS OF APPLICATIONS FOR URANIUM MILLING LICENSES. (Directorate of Regulatory Standards (AEC), Washington, D. C. 9 Feb 1973. 1p. DRS, Washington, DC. Free.

27570 DISTRIBUTION OF THE RADIOELEMENTS POTASSIUM, URANIUM, AND THORIUM IN SELECTED PORPHYRY COPPER DEPOSITS. Davis, J. D.; Guilbert, J. M. (Univ. of Arizona, Tucson). Econ. Geol.; 68: No. 2, 145-160(1973).

The distribution and zoning of potassium, uranium, and thorium in the porphyry copper ore bodies at Ajo, Mineral Park, and Morenci, Arizona, and at Santa Rita, New Mexico, were determined with a truck-mounted multichannel gamma spectrometer. The geophysical data trends compare favorably with the trends of chemically analyzed potassium from a profile across each mine, while uranium correlates poorly. The study revealed that a central zone of high potassium content consistent with models for alteration zoning of porphyry copper deposits is present at Mineral Park and Santa Rita, while a less explicit but interpretable distribution of potassium is present at the New Cornelia mine and at Morenci. The intensity of thorium radiation is less distinctly zoned. Uranium is concentrated either centrally or peripherally, apparently depending on local factors affecting magma crystallization, hydrothermal activity, and supergene effects. Potassium at each mine is enriched as much as twice over similar barren intrusions, while uranium is irregularly enriched. The zonations observed agree well with established geochemical behavior for these elements and with presently accepted alteration models. Potassium enrichment appears to be sufficient and potassium zoning adequately distinct to make its spectrometric detection valuable in exploration, but disequilibrium in the uranium series and irregularity of uranium distribution makes gamma detection of uranium less useful. Gamma detection of thorium appears to be of little value. (auth)

27571 DISSOLVED HELIUM IN GROUNDWATER: A POSSIBLE METHOD FOR URANIUM AND THORIUM PROSPECTING. Clarke, W. B.; Kugler, G. (McMaster Univ., Hamilton, Ont.). Econ. Geol.; 68: No. 2, 243-251(1973).

Measurement of dissolved helium in groundwater should indicate the presence of uranium (or thorium) mineralization. Such measurements were made near two known deposits, near Elliot Lake, Ontario, and near Inda Lake, Labrador. Helium contents of up to 600 times normal solubility were found, while neon contents were all within 20 percent of solubility equilibrium with the atmosphere. The ratio $^4He/^3He$ is correlated with ^4He content for the samples, although ^3He is enriched above solubility (up to a factor of 6) in some cases. Tritium content was measured for the Labrador samples and indicate that the water residence time is less than 20 years. This rules out the possibility that the high helium values are due to rocks of normal uranium and thorium content. (auth)

27572 CONSIDERATIONS ON THE URANIUM MINERALIZATION OF THE DEPRESSION OF VIAR (SEVILLE). de Acha Aracama, A.; Suarez Mahou, E. (Junta Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 16: No. 78, 479-491(1972). (In Spanish).

After a brief description of the Depression, especially of its materials and morphology, a resume is made of the uranium mineralizations. The presence of carnotite and minerals of the uranocircite-autunite series stand out. The tectonic structure is considered more favorable than sedimentological discontinuities for the possibility of economic uranium. (tr-auth)

27573 ROLE OF DARK-COLORED MINERALS OF SODIUM METASOMATITES IN LOCALIZATION OF URANIUM MINERALIZATION. Zinchenko, V. A.; Rakovich, F. I. (Inst. of Geochemistry and Physics of Minerals, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 1, 15-18(Jan 1973). (In Ukrainian).

The important role of aegirine, rhibekite, chlorite, and hydrobiotite in localization of uranium mineralization is found on the basis of microscopic investigations and comparison of the composition of dark-colored minerals from ore and ore-free albitites. Dark-colored minerals of ore albitites are characterized by a low content of bivalent iron and an increased content of trivalent iron, which testified to a reducing role of bivalent iron, aegirine, rhibekite, and hydrobiotite in formation by uranium mineralization in albitites. (auth)

Radioactive Effluents

Refer also to abstracts 27663, 27901, 28117, 29581, and 29809.

27574 ATOMIC ENERGY IN THE ENVIRONMENT. Tajima, Eizo (Rikkyo Univ., Tokyo). At. Jap.; 16: No. 5, 35-47(May 1972).

With the increasing demand for electric power, the role of nuclear power has become more and more important. But as regards pollution, nuclear energy is no exception. In order to respond to this demand ideally, the following three conditions must be satisfied; radioactive wastes must be safely and economically treated and disposed; safety of environment must be assured; and nation-wide as well as international understanding and agreement on the preceding two points must be achieved. Treatment and disposal of the radioactive wastes are directly related to environmental problems, but these problems remain unsolved, and even unexplored in present development programs. By 1975 at the latest, Japan must be ready with definite measures for the treatment and disposal of low-level solid wastes. Population dose in Japan derives from world-wide power expansion. In this case, krypton-85 and tritium play the most obvious role as pollutants, so elimination of these nuclides is a task of great importance. Traditional site-by-site settlement of environmental problems will soon be no longer appropriate. It is necessary that an approach to reach the goal of "as low as practicable" is pursued. (Japan)

Radioactivity Monitoring and Transport

27575 (ORNL-EIS-72-19) SURVEY OF PAPERS ON ECOSYSTEMS ANALYSIS FROM 1947-1971 IN THE JOURNAL "ECOLOGY". McMullin, B. B. (Oak Ridge National Lab., Tenn.). Mar 1973. Contract W-7405-eng-26. 53p. Dep. NTIS $4.75.

A literary survey was conducted on all papers presented in the journal Ecology from 1947-1971. All works involving sub-processes or total systems analysis were identified and classified. A listing by author and title of papers for each year that involved the systems analysis approach to ecology is presented. Subject categories used and a semi-hierarchial Keyword list are included in the Appendix. (auth)

27576 IS POLLUTION PERMANENT. Stanford, R. W. (Royal Perth Hospital, Australia). Radiographer; 20: No. 1, 15-18(Jan 1973).

A discussion of radioactive waste disposal from power stations and dispersion of radioisotopes from nuclear weapons tests and nuclear medicine applications is given. (Australia)

27577 ^{181}W PRODUCED BY THE SCHOONER EVENT. Air Concentration and Deposition in Italy. Clemente, G. F.; Giorcelli, F. G.; Mastinu, G. G. (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy). Health Phys.; 24: No. 4, 397-401 (Apr 1973).

The values of ^{181}W concentration in air and deposition in Rome (Italy) are reported for the period December 1968 to January 1969. The origin of the ^{181}W contamination is attributable to the Schooner event, a cratering test of the Plowshare project. The total deposition of ^{181}W observed in Italy was 3765 ± 680 Ci/km^2. The ^{185}W deposition in Italy was evaluated on the basis both of the $^{181}W/^{185}W$ ratio in the main cloud of the Schooner event and of the ^{181}W deposition in Italy. The dose equivalent delivered to the bone

of 1 yr children as a consequence of the W isotope deposition was about 0.19 mrem. (auth)

Atmosphere

27578 TURBULENT DIFFUSION OF HEAVY AND RADIOACTIVE IMPURITIES IN THE BOUNDARY LAYER OF THE ATMOSPHERE. Dzholov, G. D. Khidrol. Meteorol.; 20: No. 4, 11-19 (1971). (In Bulgarian).

The problem of distribution of nonconservative impurities in the boundary layer of the atmosphere was examined. A scheme is proposed for a numerical solution of the general equation of the turbulent diffusion. The necessary coefficients for solving this equation were obtained from a closed system of equations of the turbulent movement in a stationary temperature stratified boundary layer of the atmosphere. Numerical experiments were carried out for investigating the peculiarities in the distribution of the concentration, respectively for heavy and radioactive impurities. (Abstr. Bulg. Sci. Lit. Math., Phys. Astron., Geophys., Geod.)

27579 CALCULATION OF THE RELATIVE CONCENTRATION AND MASS OF NUCLEAR EXPLOSION FALLOUT PARTICLES. Kownacka, L. (Central Lab. for Radiological Protection, Warsaw). Przegl. Geofiz.; 16: 197-208(1971). (In Polish).

Theoretical predictions were made of the relative concentration of heavy particles falling on the earth surface from a cloud that originates from a nuclear explosion. The calculations were based on a simple linear model of a radioactive cloud, whose size and maximum height in the atmosphere is the function of explosion yield. Particle size-distribution in the cloud is determined by the log-normal function, and their fall-rates were calculated by various methods depending on their respective size. The particle size-distribution on the ground as the function of the distance from the source was calculated assuming the wind velocity to be a linear function of height. The six equations were obtained determining the relative concentration of the particles on the earth's surface. GIER computer was used for numerical calculations, for small explosions producing clouds in the troposphere and for the distances covered by the local fallout. Curves on the size-distribution and mass of the particles for several distances and explosion yields are presented. Significant differences in shape of the particle size-distribution and mass-distribution for different explosion yields were found. (auth)

27580 ASSESSMENT OF DOSES IN THE WESTERN UNITED STATES FROM THE PEOPLE'S REPUBLIC OF CHINA NUCLEAR TEST OF JANUARY 7, 1972. Evans, R. B.; Snelling, R. N.; Buck, F. N. (Western Environmental Research Lab., Las Vegas, NV). Radiat. Data Rep.; 14: No. 2, 77-83(Feb 1973).

Measurable increases in airborne radioactivity were detected in the western United States by the Air Surveillance Network (operated by the National Environmental Research Center-Las Vegas, EPA) following a nuclear detonation by the People's Republic of China on January 7, 1972. The progress and intensity of the radioactive cloud across the United States are presented graphically. The highest hypothetical infant thyroid dose equivalent calculated to result from the inhalation of iodine-131 and tellurium-132 was 1.2 mrem at Pueblo, Colorado. (auth)

27581 CALCULATIONS OF ENVIRONMENTAL RADIATION EXPOSURES AND POPULATION DOSES DUE TO EFFLUENTS FROM A NUCLEAR FUEL REPROCESSING PLANT. Martin, J. A. Jr. (Environmental Protection Agency, Rockville, MD). Radiat. Data Rep.; 14: No. 2, 59-76(Feb 1973).

Effluent and environmental data pertinent to the Nuclear Fuel Services nuclear fuel reprocessing plant in West Valley, N. Y., were analyzed to determine doses to sample populations. Individual doses to the maximally exposed population group were considered. Population doses (man-rems) from air, fish, deer, and water pathways were calculated. The most significant radionuclides contributing to doses were tritium, krypton-85, strontium-90, cesium-134, and cesium-137. It was concluded that the impact of this facility upon humans was well below applicable guides in 1971. (auth)

27582 DATA. Section IV. Other Data. Radiat. Data Rep.; 14: No. 2, 125-128(Feb 1973).

Data are reported on the gross β activity in samples of atmospheric particulates and liquid waste effluent at the Brookhaven National Laboratory site during July through December 1970. (CH)

27583 DATA. Section III. Air and Deposition. Radiat. Data Rep.; 14: No. 2, 115-124(Feb 1973).

Data are presented on the gross β activity from fallout in samples of airborne particulates and precipitation collected at various locations throughout North, Central, and South America during 1972. (CH)

27584 GLOBAL INVENTORY AND DISTRIBUTION OF FALLOUT PLUTONIUM. Hardy, E. P.; Krey, P. W.; Volchok, H. L. (Atomic Energy Commission, New York). Nature (London); 241: No. 5390, 444-445(16 Feb 1973).

It is stated that an accidental stratospheric injection of ^{238}Pu in 1964 resulted in almost a three-fold increase in global fallout of this nuclide. The accumulated fallout and its geographical distribution from this release, as well as from weapons testing, are here reported. The accidental release occurred from a ^{238}Pu power generator carried on a navigational satellite, launched from California, whose rocket failed. Stratospheric checks indicated that by mid-1970 95% of the ^{238}Pu had been deposited on the Earth's surface, and it was important to determine how this was distributed and to record the deposit. Soil analysis was used for the determination. From October 1970 until January 1971 sixty-five sites around the world were sampled. Determinations of ^{239}Pu and ^{240}Pu, assumed to be entirely derived from weapons testing, were also made. Data are shown tabulated. The weapons ^{238}Pu contribution was obtained by multiplying the $^{239,240}Pu$ values by 0.024. The distribution pattern for weapons Pu showed heaviest deposition in the Northern Hemisphere temperate latitudes and a minimum in the equatorial region. The satellite ^{238}Pu showed a different distribution pattern, most debris having deposited in the Southern Hemisphere. The total ^{238}Pu deposit was 326 ± 36 kCi, and the weapons ^{238}Pu 7.7 ± 0.9 kCi. The estimate of the satellite ^{238}Pu deposit was 13.9 ± 2.2 kCi. (UK)

27585 APPLICABILITY OF GREENFIELD'S MODEL IN THE INVESTIGATION OF FALLOUT AND ATMOSPHERIC RADIOACTIVITY IN POLAND. Kwapulinski, J. Nukleonika; 17: No. 12, 639-646(1972). (In Polish).

The influence of geographical latitude, altitude, and monthly rainfall on the ratio of fallout—mCi/km^2 to atmospheric radioactivity—pCi/m^3 is discussed. The range of this ratio in Poland can be described by Greenfields formula. Between the atmospheric radioactivity and the fallout, there was close correlation. (auth)

27586 REPORT OF A MEETING ON RADIATION AT HIGH ALTITUDES. Webb, G. A. M. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 2, 20-21 (Jan 1973).

A very brief report is made of a one day meeting held in London on October 10, 1972. The following topics were discussed: (1) The nature and distribution of radiation to be expected in the stratosphere, including that resulting from nuclear tests, contributions from plutonium released on burnup of a SNAP generator, galactic cosmic rays, and solar proton flares. (2) Fundamental criteria for aircraft structure and assessment of the operational effects of radiation protection criteria. (UK)

Soil

27587 COMPLEX MEASUREMENT OF ^{222}Rn AND ^{220}Rn EXHALATION VALUES. Styro, B. I.; Nedvetskaite, T. N.; Dargene, N. P. (Inst. of Physics and Mathematics, Vilnius, USSR). Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana; 7: No. 5, 562-564(1971). (In Russian).

Radon-220 and radon-222 were determined simultaneously with sensitivities of 7×10^{-17} and 5×10^{-19} Ci/cm^2-sec, respectively, and with a relative error of ±20% using a Pearson collector modified to use a corona discharge of the air sample analyzed. Results of soil release measurements during September and October 1969, show a maximum in ^{222}Rn exhalation shortly after noon each day, and for ^{220}Rn during the first half of night. Another maximum for both radionuclides was observed during a temperature change occurring in the soil after sunrise. (ERB)

Water

27588 DATA. Section II. Water. Radiat. Data Rep.; 14: No. 2, 101-114(Feb 1973).

Data are presented on: the gross α-β radioactivity in samples of surface waters collected in Kansas during 1971; the content of tritium in surface waters and drinking water sampled at various locations throughout the USA during 1972; and the content of tritium and gross α-β activity in samples of surface waters collected in the offsite area surrounding the Nevada Test Site during April through June 1972. (CH)

27589 ^{226}Ra CONCENTRATIONS IN TAIWAN HOT SPRING AND RIVER WATERS. Tsai, C. M.; Weng, P. S. (National Tsing Hua Univ., Hsinchu, Taiwan). Health Phys.; 24: No. 4, 429-430 (Apr 1973).

The Peitou hot spring, situated in suburban Taipei and nearby hot spring and river waters were analyzed for ^{226}Ra since the Peitou stone or hokutolite is known to contain about 1.5×10^{-11} g

radium per gram. The results are tabulated. The Peitou hot spring was the only source giving a concentration in excess of the maximum permissible concentration allowed for public drinking water of 10 pCi/1. The concentration measured was 15.90 ± 0.09 pCi/1 (alpha) and 33.80 pCi/1 (beta) and it is thus advised that this spring water should not be drunk. (UK)

Ecosystems and Food Cycles

Refer also to abstracts 27608, 27950, and 28071.

27590 (BNWL-1650(Pt. 2)) PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1971 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. Volume I. Life Sciences. Part 2. Ecological Sciences. Vaughan, B. E. (Battelle Pacific Northwest Labs., Richland, Wash.). Dec. 1972. Contract AT(45-1)-1830. 129p. Dep. NTIS $3.00.

Separate abstracts were prepared on three sections of this report. A list of 40 publications during the period covered is included. (CH)

For abstracts of individual sections see: 27608, 27950, and 28071.

27591 (CONF-720818-, pp 423-435) STRONTIUM IN THE ENVIRONMENT. Ivanov, S. N.; Shagalova, E. D. (Scientific Research Inst. of Soil Science and Agricultural Chemistry, Minsk). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Experimental results indicate that lupine accumulates and subtracts more strontium-90 than potato tops, maize, and clover. Cereal crops, potato tubers, and sedge-cereal herbage do not accumulate strontium-90. (auth)

27592 (CONF-720818-, pp 437-446) ARE THE RATE FACTORS IN THE ^{90}Sr PREDICTION MODELS CONSTANT? Aarkrog, A. (Danish Atomic Energy Commission Research Establishment, Risoe). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The prediction models for ^{90}Sr in the human food chain have yielded values higher than those observed. The models for milk were corrected by introduction of an exponential factor taking the increasing unavailability of the accumulated ^{90}Sr in the soil into account. However, for certain food items, first of all grain and grain products, this correction has not been sufficient to obtain agreement between observed and predicted values. The possibility of a variation of the rate factors in time is considered and reasons for such a variation are discussed. (auth)

27593 (CONF-720818-, pp 457-468) FALLOUT ^{90}Sr IN DIET AND HUMAN BONE. Bennett, B. G. (Atomic Energy Commission, New York). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Since the results from New York and San Francisco are quite typical of diet and bone sampling results of many countries, the methods described here should be generally useful in providing correlations of fallout ^{90}Sr levels in diet and man. The deposition-milk, milk-total diet, and diet-bone relationships appear to be fairly well substantiated. Strontium-90 analyses for a few additional years should further verify the long-term aspects of the models and increase the reliability of our assessment of the behavior of ^{90}Sr in man and in the environment. (auth)

27594 (CONF-720818-, pp 477-482) ^{90}Sr INTAKE IN FOOD BY THE POPULATION OF THE SOVIET UNION, 1963–1971. Knizhnikov, V. A.; Petukhova, E. V.; Barkhudarov, R. M. (Inst. of Biophysics, Moscow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16–19 Aug 1972.

An intake of Sr-90 to the population of the Soviet Union with the diet in 1969 as compared to 1964—the period of maximum intake—decreased by 4 times. In 1970–71 a further decrease of the diet contamination was not observed. In 1963–71 the role of individual components of the diet as sources of strontium-90 essentially changed, the significance of bakery products being reduced and that of milk and meat increased. Changes in the significance of individual components of the diet as strontium-90 suppliers are mainly due a decrease of an air component of diet contamination and an increase of a soil one. The data of strontium-90 assimilation from the diet in the USSR (accumulation multiple in the body and observed ratio "skeleton-diet") essentially differ from those in the countries with a western type of diet, this difference clearly tending to disappearance. A reduction of the difference in the data of strontium-90 assimilation between the USSR and the USA and an increase in the data of strontium-90 assimilation are associated with a reduced contribution of an air component into diet contamination. (auth)

27595 (CONF-720818-, pp 483-488) ^{90}Sr IN DIET, 1971. Warren, J. M. (Western Regional Hospital Board, Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Strontium-90 was estimated in seven groups of foodstuffs composited to represent a comprehensive sample of diet in the Glasgow and West of Scotland region. From the results, the daily dietary intake of calcium and strontium-90 was calculated. In an attempt to assess regional variation in diet, a survey was made of strontium-90, stable strontium, and calcium in milk on a given day. The samples were drawn from Glasgow and its surrounding residential district. (auth)

27596 (CONF-720818-, pp 505-512) RADIOBIOASSAY PROGRAM OF THE INSTITUTIONAL TOTAL DIET SAMPLING NETWORK. IV. Evaluation of the ^{90}Sr Data for Children. Moghissi, A. A.; Mayes, M. G.; Carter, M. W. (Western Environmental Research Lab., Las Vegas, NV). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The Institutional Total Diet Sampling Network Program (ITDSNP) has produced data that were utilized in formulating an estimated dose to children resulting from the radionuclides introduced into the environment by nuclear weapon tests. The subjects of study were children with ages ranging from 6 to 18 years. The radiobioassay program of the ITDSNP was instituted in 1966 to estimate the excretion and retention of radionuclides simultaneously with the study of dietary intake, and to attempt to better evaluate the relative contributions of various radionuclides to the exposure of human populations. The nuclide of particular interest in this study is strontium-90. (ERB)

27597 (CONF-720818-, pp 513-520) STABLE STRONTIUM: CALCIUM RATIOS IN U.S. BONE AND TOTAL DIET SAMPLES. Strong, A. B. (Environmental Protection Agency, Montgomery, AL); Porter, C. R.; Kahn, B. 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The mean of 479 Sr : Ca ratios in bones of persons aged 0 to 26 years in the United States is 0.23 ± 0.06 mg/g, and the values are distributed log-normally. No trend of the ratio with age was observed, and all mean values for age categories were between 0.20 and 0.24 mg/g. Differences of ratios among sampling locations were only slightly greater, with means ranging from 0.20 to 0.27 mg/g from 12 city and 6 area categories. The strontium : calcium ratios in diet samples from 22 institutions showed a considerably greater variation. The mean value was 1.40 ± 0.21 mg/g with extreme values from 0.89 ± 0.05 mg/g at Portland, Maine, and Boston, Massachusetts, to 2.41 ± 0.33 mg/g at Phoenix, Arizona. Although these strontium : calcium ratios in bone and diet cannot be directly compared, the data suggest that the human metabolism has a significant dampening effect on strontium retention relative to that of calcium. (auth)

27598 CESIUM-137 AND STABLE CESIUM IN A HYPEREUTROPHIC LAKE. Eyman, L. D. East Lansing, MI; Michigan State Univ. (1972). 113p. University Microfilms Order No. 73-5367.

Thesis (Ph. D.).

The input of ^{137}Cs and stable Cs and their distribution among the various components of an aquatic ecosystem were studied in a lake exhibiting an advanced stage of eutrophy. Components sampled and analyzed for these two isotopes of cesium included water, sediments, macrophytes, filamentous algae, zooplankton, and several species of fish. Most of the cesium pool (87% ^{137}Cs; 98% stable Cs) was associated with the sediments. Stable Cs enters the lake primarily in an organically bound state as migratory waterfowl excreta and is deposited to the sediments. Cesium-137 enters as a soluble inorganic form and is distributed throughout the system. Specific activity (pCi ^{137}Cs/ng stable Cs) of the sediments is lower than other components of the system

due to the different modes of entry of the two isotopes of cesium. A trend of increased ^{137}Cs concentration at higher trophic levels is demonstrated for those fish that are free-ranging limnetic feeders. No such trend is evident for stable Cs. Forms closely associated with sediments have higher ^{137}Cs concentrations than expected based on their feeding habits. On the dates samples were collected, specific activity in limnetic fishes was constant but was variable in other forms. The degree of association of biotic forms with sediments is reflected in their specific activity. (Diss. Abstr. Int., B)

27599 DATA. Section I. Milk and Food. Radiat. Data Rep.; 14: No. 2, 85-100(Feb 1973).

Data are presented on the content of fallout ^{137}Cs, ^{131}I, ^{89}Sr, and ^{90}Sr in samples of milk collected from various locations throughout Central, North, and South America during 1971 and 1972. Methods used for evaluating the radiation dose to the human population from the uptake of fallout nuclides, using milk as the indicator food, are reviewed. (CH)

27600 TASKS AND ACHIEVEMENTS IN THE INVESTIGATIONS OF ARTIFICIAL RADIONUCLIDES. Migration in forest Biogeocenoses. Aleksakhin, R. M.; Bocharova, M. A. Lesovedenie; No. 4, 59-70(1971). (In Russian).

Main laws of artificial radionuclide turnover in forests are described for different ways of arrival of radioactive substances to the forest biogeocoenoses. Certain peculiarities of migrations of the most important radioactive fission products (first of all ^{90}Sr and ^{137}Cs) on different phases of the turnover (non-root arrival of radionuclides, by aerial fall of radioactive particles and aerosols, absorption by forest vegetation from the soil) are considered. A general scheme of artificial radionuclide transport in the forest on the coenotic level is given with indication of its specific properties as compared with migrations of radionuclides in other types of coenoses. Main tasks of investigations of artificial and natural radionuclides in forests are outlined, as parts of forest radioecology problems. (auth)

27601 FOREIGN MATTERS AND HYGIENICALLY HARMFUL RESIDUES IN POULTRY MEAT. Grosskiaus, D. (Bundesgesundheitsamt, Berlin). Bundesgesundheitsblatt; 15: No. 3-4, 42-50(1972). (In German).

This survey of hygienically harmful foreigh matters in poultry meat considers among others also residues of radioactive substances. Harmful residues of ^{90}Sr, ^{137}Cs, and ^{131}I have not been detected up to now in poultry meat, and the values of 10 to 12 pCi found in foodstuffs continue to decrease. The detection methods applied to examine meat are briefly discussed. (GF)

27602 ENVIRONMENTAL PHYSIOLOGY OF MARINE ANIMALS. Vernberg, W. B.; Vernberg, F. J. Berlin; Springer (1972). 346p.

Chapter VII of the book (entitled 'Perspectives') deals with various types of water pollution such as thermal pollution, pollution by industrial wastes, pesticides, and radionuclides. The principal sources of radioactive contamination are fallout from atomic test explosions and the use of nuclear power reactors, with the contribution from the latter activity, becoming more and more important nowadays. The cycling of radionuclides through the three components of marine environment (water, biota, and sediments), the sensitivity of individual organisms to radionuclides and hence the difficulties encountered in the establishment of general maximum permissible concentrations are briefly discussed. (GP)

Radiometric Techniques

27603 (EURISOTOP-55(Vol.1), pp 217-277) CRITICAL REVIEW OF SAND MIGRATION MEASUREMENTS PERFORMED WITH RADIOACTIVE TRACERS IN GERMAN COASTAL AREAS. Pahlke, H.; Grimm-Strele, J. (Versuchsanstalt fuer Wasserbau und Schiffbau, Berlin). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Opinions are expressed on the choice of the place and times of measurement, the need for pilot experiments, the advisability of using model or natural sediments, the labeling of sands with tracers, the application of the indicators to the sea bed, the measurement and recording of tracers, the interpretation of the corresponding observed values and the possibilities of verifying the results by other methods. (auth)

27604 (EURISOTOP-55(Vol.1), pp 335-378) NUCLEAR METHODS IN HYDROLOGY FOR CONSTRUCTION ENGINEERING. Moser, H.; Neumaier, F. (Gesellschaft fuer Strahlenforschung, Munich). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Procedures for hydrological studies in ground water and surface water using the natural isotope content and tracer methods are described. The basic physical and metrological principles are reviewed. This is followed by an account of the hydrological interpretation of the measured data, with practical examples from hydraulic, foundation, and highway engineering. Determination of the flow of percolating waters into an earth dam and measurement of ground water flow in the vicinity of ground water lowering points and in the area of an underground railway are described. (auth)

27605 (EURISOTOP-55(Vol.1), pp 379-401) TRACERLOG: A NEW BOREHOLE TECHNIQUE FOR MEASURING GROUND WATER WITH RADIOACTIVE ISOTOPES. Drost, W. (Gesellschaft fuer Strahlenforschung, Munich). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Measurement of vertical flows in ground water borings provides information as to the ground water flow net and the piezometric distribution in the ground water conducting layer. In order to measure these vertical flows, Tracerlog techniques were developed. The basic principle is that a probe consisting of an injector with a radioactive tracer solution and two detectors is logged in the ground water boring. The radioactive tracer is injected in point form or continuously. With point form injection, measurements vs time are made of the displacement of the injected tracer cloud relative to the detectors of the measuring probe, while with continuous injection the tracer concentration is measured. With both forms of measurement the values obtained are the flow velocity and the direction of low of the vertical current. Using these techniques more than 2000 m of borehole were measured in a very short time. They were used in connection with problems of foundation, transport, and hydraulic engineering. (MCG)

27606 NATURAL RADIOCARBON. Suess, H. E. (Univ. of California, La Jolla, San Diego). Endeavour; 32: No. 115, 34-38(Jan 1973).

Libby (1952) found that on the surface of the Earth the element carbon contains minute amounts of its radioactive isotope with mass 14. Since then, measurements of this isotope in natural carbon have contributed to a remarkably large number of branches of science. In this article examples from the fields of pleistocene geology, paleolithic and neolithic archaeology, geochemistry, geophysics, oceanography, as well as cosmic-ray and solar physics are discussed. (auth)

27607 THEORY FOR THE QUANTITATIVE ESTIMATION OF BED LOAD TRANSPORT USING RADIOISOTOPES. Krishnamurthy, K.; Rao, S. M. (Bhabha Atomic Research Centre, Bombay). Isotopenpraxis; 8: No. 11-12, 455-457(1972).

An attempt was made to develop a simple theory for the application of radiotracer techniques to estimate the quantum of bed material transported in rivers, estuaries, etc. The emphasis is mainly on the physical concepts involved. Certain assumptions made in the theory are later verified experimentally. (auth)

Site Surveys

Refer also to abstracts 29616, 29618, 29639, 29648, 29651, 29655, 29664, 29685–29689, 29695, 29715, and 29809.

Thermal Effluents

Refer also to abstracts 27590 and 29840.

27608 (BNWL-1650(Pt. 2), pp 1.1-1.27) AQUATIC ECOLOGY. Dec 1972.

In Pacific Northwest Laboratory annual report for 1971 to the USAEC Division of Biology and Medicine. Volume I. Part 2.

Poikilothermous animals in aquatic habitats maintain body temperature essentially the same as the surrounding water. The basic response of these organisms to a temperature increase is an increase in their metabolic rate, which may be accompanied by an increase in their rate of development. Ultimately a point is reached near the critical thermal maximum where energy expended in metabolism will exceed the energy acquired by feeding and development is subsequently retarded. Results are reported from laboratory studies on the develomental responses of animals of the Columbia River to thermal stress such as may occur below outfalls of nuclear power plants. Data are included on: the blackfly (Simulium viltatum) during metamorphosis from larvae to pupae and pupae to emergent adult; crayfish (Pacifasticus trowbridgii; steelhead trout (Salmo gairdneri); and bullheads (Ichalurus nebulosus). The possible effects of tritium in liquid effluents from

nuclear power plants were investigated in rainbow trout (Salmo gairdneri). Eggs were immersed in spring water containing 0.01, 0.1, 1.0, and 10.0 μCi/ml tritium and the effects of short range β particles on embryogenesis, egg hatching, the incidence of developmental anomalies, and antibody production in mature fish were studied. Data are included from studies on the levels of Hg in the Columbia River; a laboratory study on the effects of water temperature on the uptake of mercury by fish in which ^{203}Hg was used as the tracer; and the synergistic effects of thermal effluents, chemical pollutants, and nitrogen gas supersaturation on the resistance of Columbia River bass (Micropterus salmoides and M. dolomieui) to parasites (Monogenea sp.), bacterial (Chondrococcus columnaris) infections, and the development of gas bubble disease. (CH)

27609 THERMAL DISCHARGE: ENGINEERING AND ECOLOGY. Thermo-Fluids Conference Held in Sydney, Australia, December 4–7, 1972. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972). 121p. (CONF-721217–).

Seventeen papers on aspects of thermal discharge, and resultant heating and cooling of the environment were presented. Eight papers have separate abstracts. (Australia)

For abstracts of individual papers see: 27500 and 27610–27616.

27610 THERMAL DISCHARGE CONSIDERATIONS IN POWER PLANT SITING. List, E. J. pp 1-6 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

The growth in per capita electrical energy use associated with increases in material well being, coupled with the shift to thermal generating plant, leads to large demands for condenser cooling capacity. So, in many areas of the world the siting of power plants is being constrained by thermal discharge problems. The magnitude of this heat rejection problem is presented, and strategies for minimizing the environmental impact of ocean sited plants are considered, in particular how cooling water discharge momentum and ocean density stratification may be exploited to reduce thermal effects on marine biota. Results of recent laboratory and design investigations are presented. Inland siting is considered and comparisons are made between the operation of cooling towers and ponds in arid regions. Sources of evaporative cooling water are discussed, and in particular a comparison is made between the incremental evaporation produced by the construction of hydroelectric plants in arid areas and the requirements of thermal plants. It is concluded that adequate once through cooling capacity should exist for properly designed coastal plants and that if there is sufficient inland water to support the population to use electricity there will be adequate cooling water to produce it. (auth)

27611 ENVIRONMENTAL CONSIDERATIONS OF WASTE HEAT DISPERSAL FROM POWER GENERATION. Howard, K. A. pp 7-14 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

Current methods of electrical power generation by conversion of thermal energy produce large quantities of waste heat. Various cooling water systems for dissipating waste heat to the atmosphere have been evolved. The determination of the effects of thermal discharges on the environment during the heat transfer process presents problems. Methods involving studies of physical conditions, determination of heat dispersal patterns by hydraulic model, and biological studies of the ecosystem were developed for problem solution. (auth)

27612 ENERGY FOR AUSTRALIA'S FUTURE AND ITS IMPLICATIONS FOR MARINE WATERS. Fryer, J. J. pp 20-27 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

The heat dissipated in Australia during 1970/71 was approximately $2{,}150 \times 10^{12}$ kJ of which about 29% came from transportation and 18% came from thermal power stations. Three-quarters of all the heat came from a dozen of the main urban and industrial regions of Australia. In Melbourne, the heat dissipated was equivalent to 2% of the annual solar radiation received at ground level. Up to 130,000 Ml of water was evaporated from Australian cooling water systems using both fresh and saline waters. By 2000/1 Australian energy requirements could increase five fold. Approximately 800,000 Ml of water may then need to be evaporated annually by Australian thermal power stations. This requirement equals the anticipated urban water supply for Melbourne. The use of seawater for cooling purposes can provide a major contribution to available water resources of Australia. Careful utilization of these marine resources will necessitate detailed physical, chemical, and biological investigations as typified by those for the Newport Power Station. (auth)

27613 ANALYSIS AND PREDICTION OF COOLING FIELDS IN LAKES. Coulter, C. G.; Guthrie, A.; Kirkwood, J. B.; Lamb, A. N.; Watson, K. S. pp 28-36 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

When a conceptual model assuming no mixing in the cooling field is used to predict the areas of heated water at Vales Point, Munmorah, and Liddell Power Stations in New South Wales, the comparison between predicted and observed areas shows that where mixing occurs, the areas of heated water in the higher temperature zone are over-estimated. The actual measured areas at a specific time may also differ from the predicted area because of the large inertia of the cooling field and the distorting effect of winds. (auth)

27614 THERMAL DISCHARGE FROM POWER STATIONS. Coulter, C. G.; Guthrie, A.; Kirkwood, J. B.; Lamb, A. N.; Watson, K. S. pp 37-45 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

Alternative methods of handling power station reject heat are reviewed. Where it can be used, the once-through system has several advantages over the alternatives. All N.S.W. power stations using this system are located in coastal areas where no deleterious effects have been found in over 50 years of operation. The behavior of cooling ponds is reported and the relative water use of these and cooling towers is examined. Where water storage is required to safeguard continuity of operation, a combined storage and cooling pond may be shown to conserve water and be economically and aesthetically attractive. Data on the optimum sizing of cooling lakes are given. The dispersal of warm water plumes in lakes is described and a typical energy balance is given. (auth)

27615 LETHAL EFFECTS OF HOT WATER. Powles, P. M. (Trent Univ., Peterborough, Ont.). pp 52-59 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

A series of widely accepted ecological working concepts is briefly reviewed, and used to compare and relate the eastern Australian Tuggerah estuaries to other regions of the world where thermal effects have been documented. Using pertinent Australian information, vulnerabilities to increased thermal loading are suggested, and a number of general predictions made. Precious threatened species include the greasy-back prawn (Metapenaeus bennettae Racek and Dall) and garfish (Hemirhamphus ardelio Whitley), which spawn in lagoons or estuaries. Other vulnerable species are the eastern King prawn (Penaeus plebejus Hess) and mullet (Mugil cephalus L.) which are tied to estuaries through one of their life cycle stages. Some future research needs are suggested, such as establishing criteria on temperature limitations and more temperature tolerance studies. Theoretical considerations are given towards "replacement" species for warm-temperate organisms that during the summer are presently living uncomfortably close to their upper lethal temperatures. (auth)

27616 COOLING CAPACITY OF PARRAMATTA AND DUCK RIVERS: CASE STUDY. Morrison, W. R. B.; Pocock, A. W. pp 90-98 of Thermal Discharge: Engineering and Ecology. Storr, E. D. (ed.). Sydney; Institution of Engineers (1972).

From conference on thermal discharge: engineering and ecology; Sydney, Australia (4 Dec 1972). See CONF-721217–.

An experimental investigation and subsequent modeling of the thermal behavior of that section of the Parramatta–Duck River system that provides cooling water for the Shell Clyde Refinery at Granville in New South Wales is described. The objectives of the investigation were to establish a method of predicting inlet cooling water temperatures for varying rates of heat rejection for the refinery and to evaluate the various alternatives available for reducing the inlet cooling water temperature by modifying the existing cooling water system. (auth)

27617 INFLUENCE OF THERMAL EFFLUENTS ON FISHERY. Tanii, K. (Japanese Fishery Resources Conservation Association, Tokyo). Genshiryoku Kogyo; 18: No. 9, 3-6(Sep 1972). (In Japanese).

A review is presented of the following topics related to thermal effluent effects on marine organisms: temperature ranges tolerated by marine organisms; consumption and supply of fishery products; effects of thermal effluents on seaweeds near the exit of salt manufacturing plants; optimum temperature ranges for her-

ring, sardines, and tuna; and use of thermal effluents in bream breeding programs. (HLW)

27618 TECHNICAL PROBLEMS IN THE COUNTERMEASURES TO THERMAL EFFLUENTS FROM NUCLEAR POWER PLANTS. Senshu, S. I. (Central Research Inst. of Electric Power Industry, Chiba, Japan). Genshiryoku Kogyo; 18: No. 9, 13-22(Sep 1972). (In Japanese).

Large amounts of warm water are discharged from nuclear power plants, in comparison with the case of thermal power plants. This presents the problem of environmental disruption, especially in connection with the siting of nuclear power stations. The mechanism of warm water diffusion in the case of seawater discharge from condensers, and also methods of its actual survey are described. The practice of cold-water cooling and discharge in the United States in particular is reviewed. The following techniques of reducing the problem of warm condenser-cooling water are then explained: heat removal with atmospheric air, including direct air cooling of condensers, cooling of coolant by atmospheric air, and usage of cooling ponds; and lowering the temperature of warm seawater, for example by mixing the condenser water with low temperature water at the outlet to sea, forced mixing of the warm seawater with the cool water by air bubbles at the outlet, and release of the warm seawater at deep in the sea. (Japan)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 27778.

27619 (IFVE-OP-71-106) APPLICATION OF THE KICKER MAGNET WHEN PROPORTIONING PARTICLES FOR A BUBBLE-CHAMBER. Aleev, A. N.; Galyaev, N. A.; Gorshkov, V. M.; Grachev, M. I.; Gulyamov, U. G.; Danil'chenko, I. A.; Kolesnik, V. G.; Kochurov, A. G.; Lyubimov, V. B.; Nebol'sin, D. N.; Parshin, E. A.; Prilepin, A. A.; Solov'ev, M. I.; Uglekov, V. Ya. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1971. 12p. (In Russian). INIS.

The fundamental characteristics of and the main feature of the schematic diagram are presented for a kicker magnet. Monitoring of the number of particles in the TPK-500 and the Mirabelle bubble chamber is discussed. (tr-auth)

General Detectors and Monitors

Refer also to abstracts 29003, 29110, 29156, and 29790.

27620 (BRH-DEP-73-3, pp 27-38) USES OF RADIATION SAFETY MONITORING EQUIPMENT. Loftus, T. P. (National Bureau of Standards, Washington, DC). Oct 1972.

In radiation safety and protection in industrial applications.

The basic characteristics and uses of ionization chambers, G–M counters, and scintillation survey meters for radiation monitoring are briefly reviewed. (WHK)

27621 (CEA-R-4400) CALCULATION OF THE RESPONSE OF BONNER SPHERES WITH LiI, He, AND Mn DETECTORS. Comparison With Experimental Data for LiI. Caizergues, R.; Poullot, G. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Dec 1972. 66p. (In French). Dep. NTIS (U. S. Sales Only) $5.50.

A method of calculating the response of Bonner spheres containing various different detectors (LiI crystals, BF_3 counters, ^3He counters, ^{55}Mn detectors) is presented. A comparison is made between the measured and calculated responses as a function of the energy of the incident neutrons on the spheres in the energy range where such measurements are possible. Calculations made for ^6Li, ^3He and ^{55}Mn detectors are presented. (France)

27622 CHARACTERISTICS OF ELECTRON-EMISSION NEUTRON DETECTORS HAVING EMITTERS MADE OF Ag, ^{109}Ag, Rh, and Gd. Emel'chnov, I. Ya.; Volod'ko, Yu. I.; Egorov, O. K.; Konstantinov, L. V.; Postnikov, V. V. At. Energ. (USSR); 34: No. 3, 203-205(Mar 1973). (In Russian).

Absolute sensitivities of electron-emission neutron detectors were measured in a reactor zone in which the thermal neutron flux did not exceed 1.3×10^{12} neutrons. The emitter materials studied were Ag, ^{109}Ag, Rh, Al–Gd alloy, and a stainless steel with 0.5% added Gd. The results of the measurements are compared and evaluated. (KSW)

27623 BACKGROUND CURRENT OF THE LIQUID IONIZATION CHAMBER. Nakayama, T.; Kawano, M. (Nagoya Univ., Japan). Nucl. Instrum. Methods; 108: No. 1, 203-204(1973).

Background currents of a liquid ionization chamber filled with n-hexane have been measured. When the conductivity of n-hexane is smaller than $\approx 5 \times 10^{-17}$ mho/cm, the observed currents can be explained by Plumley's molecular dissociation theory. (auth)

27624 INTENSITY CALIBRATION OF MEDIUM ENERGY NEUTRON GENERATORS BY THE $^{115}In(n,n')^{115m}In$ REACTION. Rosner, B.; Ben-Hagay, E. (Technion-Israel Inst. of Tech., Haifa). Nucl. Instrum. Methods; 108: No. 1, 197-198(1973).

A simultaneous determination of both the intensity of neutrons emitted from neutron generators employing the $D(d,n)^3He$ reaction and also the background thermal neutrons is described. The method is based on the measurement of the γ-activity produced in the $^{115}In(n,n')^{115m}In$ and $^{115}In(n,\gamma)^{116m}In$ reactions. (auth)

27625 DETECTION EFFICIENCY OF ANNULAR GEOMETRY USED IN FISSION ISOMER STUDIES. Namboodiri, M. N.; Ruddy, F. H.; Alexander, J. M. (State Univ. of New York, Stony Brook). Nucl. Instrum. Methods; 108: No. 1, 1-9(1973).

The calculation of the detection efficiency for annular geometry employed in several recent studies of fission isomers is described. The calculations cover both thin target and thick target recoil experiments. A method is presented for determining the half life of a fission isomer from the radial distribution of fission fragments observed in the annular detector. The overall efficiency of the detector is calculated for use in cross section measurements. These overall efficiencies are applicable in both track detector and semiconductor experiments that employ annular geometry. (auth)

27626 EXPERIMENTAL GAMMA RAY RESPONSE FUNCTION FOR THE OSO-7 SPACECRAFT. Higbie, P. (Univ. of New Hampshire, Durham); Forrest, D.; Gleske, I.; Chupp, E. Nucl. Instrum. Methods; 108: No. 1, 167-176(1973).

The energy and angular response of the University of New Hampshire solar gamma ray monitor (a CsI(Na)-shielded NaI(Tl) detector) on the OSO-7 spacecraft has been measured. The fully loaded and rotating spacecraft was exposed to strong gamma sources while data were collected through the spacecraft telemetry system by a minicomputer under real time control. The response function was measured for gamma ray energies of 0.393, 0.662, 1.12, and 2.75 MeV for typical angular increments of 15°. The actual means of carrying out the measurements are described in detail, since these techniques may be valuable for the calibration of future experiments (e.g., on HEAO-A) where the properties of the spacecraft itself must be taken into account. The results and interpretation of the energy dependent absolute response function are given. (auth)

27627 MINIMAL THRESHOLD OF PULSE-SHAPE DISCRIMINATORS. Doolin, V. A.; Lityaev, V. M. (Inst. of Physics and Energetics, Obninsk, USSR). Nucl. Instrum. Methods; 108: No. 1, 157-160(1973).

A theoretical analysis is given of the characteristics for pulse-shape discriminators used in fast neutron spectrometry (scintillation counters based on organic scintillators). Possible minimum thresholds for several discriminator types using the zero-cross method and the method of comparison of a full charge with its part are calculated. It is shown that the energies at which the given efficiencies of ϵ_p (protons) and ϵ_e (electron registration) are reached may be different for various discriminator types. The results of calculations are compared with the results of the experiment and the experimental data of other authors. (auth)

27628 SIMPLE GAIN CONTROL SYSTEM FOR SCINTILLATION COUNTING SYSTEMS IN SPACE EXPERIMENTS. Arens, L; Taylor, B. G. (ESRO, Noordwijk, Netherlands). Nucl. Instrum. Methods; 108: No. 1, 147-155(1973).

An automatic gain control (AGC) system for use with large area plastic scintillation detectors has been developed and tested. The reference source, called an alpha lamp, consists of a piece of NaI(Tl) scintillator doped with alpha emitting ^{241}Am and is encapsulated in an Al housing with glass window. It is optically coupled to the scintillator. The reference pulses obtained are of high level and have different time characteristics compared to true event pulses, and are distinguished by means of a pulse length discriminator. The design of the complete electronic system of the AGC is described as well as calculated and measured performances, and temperature compensation. Remaining problems connected with alpha lamps of a different scintillation material offering easier temperature compensation are discussed. (auth)

27629 POSITION SENSITIVE PARTICLE DETECTORS USED IN MAGNETIC SPECTROMETER. Fulbright, H. W.; Markham, R. G.; Lanford, W. A. (Univ. of Rochester, NY). Nucl. Instrum. Methods; 108: No. 1, 125-133(1973).

Three counters used at the focus of a magnetic spectrometer are described: a simple position sensitive proportional counter, a triple proportional counter, and a dual unit operable either as a sonic spark counter or as a position sensitive proportional counter. (auth)

27630 PARTICLE TRACK EVOLUTION IN DIELECTRIC TRACK DETECTORS AND CHARGE IDENTIFICATION THROUGH TRACK RADIUS MEASUREMENT. Paretzke, H. G. (Institut fuer Strahlenschutz, Neuherberg, Ger.); Benton, E. V.; Henke, R. P. Nucl. Instrum. Methods; 108: No. 1, 73-80(1973).

The evolution of etched tracks in dielectric nuclear track detectors is considered for the case of normally incident particles taking into account the general case of the variable track etch rate. It is shown for the first time that measurement of track radii as a function of the amount of removed surface can be used for the determination of the differential track etch rate and for particle identification. This method is particularly applicable for particle tracks which lie in the region of the detection limit. The findings are also useful in estimating the degree of optical contrast and in understanding results obtained by integral light scattering devices such as in the case of track density evaluation. (auth)

27631 RESPONSE OF COAXIAL DETECTORS TO ANISOTROPIC FLUXES. Valot, P. (CEN de Saclay, Gif-sur-Yvette, France). Nucl. Instrum. Methods; 108: No. 1, 81-85(1973).

Two methods are proposed to calculate the response of a detector to an anisotropic flux of particles. The present study relates to fluxes with the form K $\sin^n \alpha$. In the two computer programs presented to make these calculations, this form of flux is not exclusive: all forms of flux with axial symmetry are possible. The second method of calculation shows the difficulties and precautions which must be taken into account to interpret the results with the use of medium or large geometry detectors to measure a highly anisotropic flux. (auth)

27632 FORMULATION OF A COUNTING CRITERION FOR RADIOTRACER EXPERIMENTS USING TWO RADIONUCLIDES. Davies, P. T. (Shell Research Ltd., Chester, Eng.). Nucl. Instrum. Methods; 108: No. 1, 87-92(1973).

The definition of optimum counting conditions for samples labelled with two radioactive nuclides is considered, with the assumption that measurements are to be made in two counting channels and may be affected by cross-contributions. It is shown that analysis of the statistical counting errors leads to an explicit criterion of performance. Comparison with the recommendations of earlier workers shows that reduction of cross-contributions has received too much emphasis at the expense of improvement of main counting efficiencies. It is also shown how to generalize the criterion to take account of weak or strong background counting rates, and of overlap of the two counting channels. (auth)

27633 SCINTILLATION CAMERA SYSTEM. Martone, R. J.; Mueller, P. G.; Bailey, H. M. (to Picker Corp.). U. S. Patent 3,718,833. 27 Feb 1973. Filed date 18 Jun 1969. 12p.

A scintillation camera system includes an oscilloscope for producing visible indications at discrete, separate positions on a screen of a cathode ray tube in response to scintillations at corresponding locations in a scintillator. The oscilloscope includes an electron gun and beam deflecting elements which direct an electron beam to particular positions on the screen in response to scintillations. Circuitry is providing for diffusing the individual visible indications on the screen thereby reducing separations between these positions. (Official Gazette)

27634 RADIOLUMINESCENCE OF NUCLEAR PHOTOEMULSIONS. Belous, V. M.; Kartuzhanskii, A. L.; Kekhva, T. E.; Plachenov, B. T.; Shur, L. I. Zh. Nauch. Prikl. Fotogr. Kinematogr.; 17: No. 6, 454-456(1972). (In Russian).

The spectral distribution of luminescence of nuclear emulsions A2 and P, and also of AgBr + 0.1% AgI tablets was studied during excitation by α particles, β particles, and photons. Thermal quenching of the luminescence of microcrystals of the emulsion excited by β-rays at 80°K for 10 min was also investigated over the temperature range 100 to 350°K. (KSW)

27635 PROPORTIONAL COUNTER AS A POSITION-SENSITIVE DEVICE. Braid, T. H. (Argonne National Lab., IL). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 9-26(1972).

The location of the trajectory of a charged nuclear particle can be determined by a number of devices whose operation depends on characteristics of gas counters operated in the region of proportional energy response. Such devices have advantages in precision, speed, or available size over other types of position-sensitive counters. The events may be located by observing pulses on one of a set of closely spaced anode wires in a common gas volume, by measuring the drift time of primary electrons to a particular anode wire, or by determining the location of an electron avalanche along the length of a single anode. The operation of the different types of systems and the factors affecting their precision are described. Precision to less than 1 mm can be obtained in a number of ways. (auth)

27636 APPLICATIONS OF LUMINESCENT COMPOSITIONS IN LIQUID RADIOCHROMATOGRAPHY WITH TRITIUM. Vdovenko, V. M.; Bobrova, U. N.; Rys'ev, O. A.; Zharkov, A. V.; Ivanova, I. F. Russ. J. Phys. Chem. (Engl. Transl.); 46: No. 5, 678-680(May 1972).

Translated from Zh. Fiz. Khim.; 46: No. 5, 1177-1179(May 1972).

The study has shown that the considerable difference between the efficiencies of the recording of the soft β-radiation of tritium when luminescent compositions are employed in the dry scintillation method and in liquid radiochromatography is partly due to the weakening of the luminescent properties of the compositions on wetting. The lowering of the efficiency of the recording of the soft β-radiation of tritium depends on the brand of the luminescent composition and also on the wetting liquid. Organic scintillators (stilbene, anthracene) do not undergo a change in properties on wetting. It is suggested that the change in luminescent properties of phosphors which are typical semiconductors on wetting their grains may occur as a result of a change in the surface charge. (auth)

27637 OPTIMUM CONDITIONS FOR OPERATION OF FAST PHOTOMULTIPLIERS IN SCINTILLATION DETECTION SYSTEMS. Chaturvedi, S. N.; Nath, N. (Kurukshetra Univ., India). Indian J. Pure Appl. Phys.; 10: No. 6, 465-467(Jun 1972).

Through the choice of different configurations of the dynode chain, optimum conditions for obtaining the best energy resolution and high gain stability have been worked out using fast photomultipliers like 56 AVP. A similar study made using relatively low gain photomultipliers like EMI 9656 KR did not indicate any count rate dependence on its gain. (auth)

27638 DETERIORATION IN COUNTING EFFICIENCY OF A SCINTILLATION DETECTOR. Kerrigan, G. C.; O'Connor, B. H.; Thomas, W. W. (Western Australian Inst. of Tech., Perth). X-Ray Spectrom.; 1: No. 4, 163-164(Oct 1972).

A description is given of the decrease in counting efficiency of a scintillation detector with time. The attenuation of an incident beam for various wavelengths was shown to be consistent with the observation that an amorphous layer had formed on the NaI crystal. (auth)

27639 DETECTION OF SINGLE IONS BY PULSE COUNTING: APPLICATION TO ION MICROPROBE MASS ANALYZER. Dietz, L. A. (General Electric Co., Schenectady, NY). Advan. X-Ray Anal.; 15: 36-55(1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

The need to detect low intensity beams of resolved ions with keV energy is encountered frequently in mass spectrometry. It is most readily accomplished by using some form of pulse-counting detector in which ions are allowed to strike a target surface (conversion dynode) where each ion releases a pulse of low energy secondary electrons. The secondary electrons undergo further amplification in an electron multiplier or scintillator type of ion detector which is specially designed to detect single ions. Ion-to-electron conversion, amplification of the secondary electrons, efficiency of ion detection by pulse counting and dead-time corrections to observed random counting rates are all statistical processes which must be understood so that observed data can be corrected properly to obtain precise and accurate measurements. These processes are reviewed, along with some of the basic properties of ion-induced secondary electron emission from an amorphous Al_2O_3 thin film target. Ion detection in the ion microprobe is interpreted in light of these basic considerations, and several mass spectra are given for electron multiplier dynode surfaces. (auth)

27640 EVALUATION OF X-RAY IMAGE INTENSIFIERS AS DETECTORS FOR X-RAY ASTRONOMY. Andrus, W. S.; Van-Speybroeck, L. P.; Kellogg, E. M.; Gursky, H. (American Science and Engineering, Cambridge, MA). Advan. X-Ray Anal.; 15: 424-434(1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

Proposed experiments in x-ray astronomy require a detector capable of forming a high resolution image of a weak source. An x-ray image intensifier incorporating a microchannel plate (MCP) has been studied as a candidate for this application. Experiments have shown that the device is sensitive to single x-ray photons and has adequate quantum efficiency. Consideration has been given to the possibility of improving the quantum efficiency by deposition on the input surface of the MCP of a material with high photoelectric yield in the wavelength region of interest. Photographs of the output light from the image intensifier show that an x-ray photon detected at the MCP results in a spot on the film of about 60 μM diameter. Since the position of the centroid of the spot could be determined to better accuracy, the device has sufficient resolution for the contemplated experiment. Detector noise is found to be so low that it would impose no limitation on the experiment's sensitivity. The image can be retrieved and transmitted to the ground by focussing a television camera on the face of the fiber optic output of the x-ray image intensifier; the data show that a Secondary Electron Conduction vidicon is sensitive enough to see the output resulting from a single x-ray photon. An alternative technique would sense charge pulses from the MCP on a fine wire grid, avoiding the need for a phosphor and providing superior time resolution and simpler data compression. Since the detector is to be used in a satellite-borne experiment, its space qualification must be established. Two launches on sounding rockets have failed to impair the usefulness of one unit that has been studied over a pe-

riod of more than a year. A long term test of continuous performance in high vacuum has so far shown encouraging results. A count life test has shown that an MCP can last through detection of orders of magnitude more counts than could be expected in the course of a mission. X-ray image intensifiers appear entirely suitable for high resolution x-ray astronomy. (auth)

27641 EXPERIMENTAL DETERMINATION OF MODULATION TRANSFER FUNCTIONS OF FOCUSING COLLIMATORS. Jahns, E. (Medizinsche Hochschule, Hanover). Nucl. Med., Suppl.; No. 9 Suppl., 92-96(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

With focusing collimators, two methods were studied for the experimental determination of the modulation transfer function. The two methods required only a small amount of equipment. Measurements with a sun-star phantom according to Beck were inaccurate. The measurement of the modulation transfer function with sine-wave distribution of activity at various spatial frequencies yielded a satisfactory result. Aside from its technical simplicity, the method had the additional advantage of short measuring time; one modulation transfer function required approximately one half hour. (tr-auth)

27642 SCINTILLATION CRYSTAL STRUCTURE COMPRISING A SERIES OF RECTANGULAR WAFERS FORMING A BAR. Miraldi, F. D. U. S. Patent 3,720,831. 13 Mar 1973. Filed date 9 Mar 1971. 6p.

A scintillation crystal including a series of rectangular wafers having their adjacent faces adhered to one another with optical adhesive to form a bar is described. Radiation is received through a side of the crystal bar. Scintillations in the crystal are detected at the ends of the bar by means of photosensitive devices. (Official Gazette)

27643 DATA PROCESSING OF GAMMA CAMERA. Kashio, E.; Makino, S.; Asahina, K. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Japan). Proc. Jap. Conf. Radioisotop.; No. 10, 359-361(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Gamma-camera data processing needs to meet the following conditions: rapid data collection, large-capacity memory, wide range of data collection time, and special peripheral devices. There are three systems used in data processing, i.e., digital image recorder, 4096-channel pulse-height analyzer, and mini-computer. In the digital image recorder, signals of the gamma cameras are digitally recorded in industrial VTRs; it is suitable for filing original data. The pulse-height analyzer contains a 4096-word core memory, and can collect the camera data and express in various forms. Finally, concerning the data processing with the mini-computer, its functions vary widely with memory capacity and peripheral devices. An effort must be made in the future to make the data processing more easily readable and diagnostic. (JA)

27644 RECENT PROCESSING TECHNIQUES OF SCINTILLATION CAMERA DATA. Mori, M. (Japan Radiation and Medical Electronics Inc., Tokyo). Proc. Jap. Conf. Radioisotop.; No. 10, 362-364(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Two conventional procedures for processing scintillation camera data, i.e., first with two-dimensional pulse-height analyzers and second with mini-computers, and also problems associated with each procedure are explained. A system completed for trial to remove these difficulties is described. The system consists of a data collector, a data display, a main memory of 8 k-words, on-line channels, high-speed channels, magnetic drums, magnetic tapes, and a typewriter. The data collector permits on-line operation, and converts information of bright spot position to digital quantity. The information is recorded by the alternate use of two data areas. The data are stored on magnetic tapes and displayed by oscillograms with a light pen. Designation of a part of interest in any form is thus achieved. (JA)

27645 TIMING PROPERTIES OF Ge(Li) DETECTOR (ORTEC-MODEL 8100-65, G-7, 6D). Singhvi, A. K.; Gupta, D. K.; Rao, G. N. (Indian Inst. of Tech., Kanpur). pp 555-559 of Proceedings of the nuclear physics and solid state physics symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

27646 ORGANIC SCINTILLATORS WITH IMPROVED TIMING CHARACTERISTICS. Birks, J. B. (Univ. of Manchester, Eng.); Pringle, R. W. Proc. Roy. Soc. Edinburgh, Sect. A; 70: 233-344 (1972).

Theoretical and experimental studies have been made of the scintillation pulse shapes of organic scintillators. In a unitary crystal the pulse shape is characterized by the scintillation decay time τ_s. In solution scintillators additional parameters are required to describe the pulse shape: Δt, the pulse width (FWHM); t_m, the time at which the intensity reaches a maximum p_{max}; and $t_{\frac{1}{2}}$, the time at which the intensity reaches $\frac{1}{2}p_{max}$. General relations are derived for τ_s, Δt, t_m, $t_{\frac{1}{2}}$ and p_{max} for binary liquid solutions in terms of molecular parameters, and the corresponding expression is given for the scintillation pulse shape of a binary plastic solution. The scintillation pulse shapes of 4 binary liquid solutions and 12 binary and 15 ternary plastic solutions were measured using a single-photon sampling fluorometer. The results confirm the theoretical analysis. A new plastic scintillator (NE 111) with improved timing characteristics has thus been developed, and some of its applications in nuclear physics are briefly discussed. The time association of nuclear events can be measured to within 130 ps with this scintillator, the limiting factor being the time jitter of the photomultiplier itself. (auth)

27647 IMPROVEMENTS IN AND RELATING TO A METHOD OF AND APPARATUS FOR MULTI-INPUT ANALYSIS. Magneron, P.; Thi, T. T. (to Intertechnique, SA). British Patent 1,301,568. 29 Dec 1972. Filed date 19 Feb 1970. 5p.

A method is described for carrying out simultaneous analysis, as a function of time, of a number of variables. The variables are converted to recurrent electrical pulses having a frequency proportional to their amplitude. For each variable a succession of recording steps in a main buffer memory assigned to that variable records the number of pulses that appear during predetermined time intervals and then transfers this number into a single classification store. The contents of the main buffer memories are transferred into a single auxiliary buffer memory, the contents of which are transferred into the classification store, the transfer operations being carried out cyclically a number of times during each recording step. The multi-input analyser used is described in detail. It is stated to have a wide range of potential uses and is particularly useful in medical work for studying by means of an assembly of radiation detectors the distribution of short-lived radioactive substances in the body. (UK)

27648 DIGESTIVE ABSORPTION OF ^{59}Fe MEASURED WITH A PLASTIFLUOR WHOLE BODY COUNTER. Delwaide, P. A. (Univ., Liege). Nouv. Rev. Fr. Hematol.; 12: No. 5, 683-690 (Sep 1972). (In French).

The Liege whole-body counter consists of a large volume plastifluor detector having a good counting geometry. The measurements, which are based on the Compton effect, cover a wide spectral band. The efficiency is excellent (27% for ^{59}Fe). The stability of the efficiency values was confirmed for a wide range of activities. The reproducibility is excellent. The counter is thus suitable for measurements on the digestive absorption of ^{59}Fe. The decreasing body activity curve obtained after the administration of 0.1 μCi of ^{59}Fe demonstrated that the stabilization time is extremely variable, unpredictable, and often precocious. The fraction of tracer re-absorbed is calculated from the decay curve. (FR)

27649 IMPROVEMENTS TO AN AUTOMATIC COUNTER FOR RADIOACTIVE DEPOSITS ON PLANCHETS. Lloyd-Jones, C. P.; Skerrett, E. J. (Univ. of Bristol, Eng.). Analyst; 98: No. 1164, 223-226(Mar 1973).

Apparatus for the automatic counting and recording of radioactive deposits on each of twenty-four planchets for a pre-determined time has been described (Lloyd-Jones et al., Analyst; 94: 236 (1969)). More recently, a digital printer has become available. When linked to a six decade scaler and timing assembly, this printer will print out results for a single sample when either a pre-set number of counts or a pre-set number of seconds has accumulated, the alternatives being simultaneously available. A system has been developed in which this scaler-printer assembly is linked to the sample changer, so as to permit the more efficient use of time during unattended counting of up to twenty-four planchets. Mechanically, the turntable that holds the twenty-four planchets is identical with that previously described, except that a photoelectric device is substituted for the microswitch governing the alignment of the planchets beneath the end-window Geiger–Mueller tube. The system is described and results are presented. (auth)

27650 CALCULATION OF THE RESPONSE OF SCINTILLATION DETECTORS TO FAST NEUTRONS. Hausen, W.; Schweitzer, T.; Seeliger, D.; Seidel, K. (Paedagogische Hochschule, Erfurt, Ger.). Wiss. Z. Tech. Univ. Dresden; 19: No. 4, 961-964(1970). (In German).

The efficiency of liquid scintillation detectors for neutrons at 0 to 15 MeV is calculated taking into account the single and double scattering of the neutrons on hydrogen. A correction procedure for carbon recoils and nuclear reactions is included. (WHK)

27651 POSITIVE SENSITIVE PROPORTIONAL COUNTER WITH HIGH SPATIAL RESOLUTION. Stuempel, J. W.; Sanford, P. W.; Goddard, H. F. (University Coll., London). J. Phys.; E (London); 6: No. 4, 397-400(Apr 1973).

A parallel plate x-ray proportional counter with a position-sensitive anode is described. It is capable of resolving 0.2 mm in the soft x-ray region over a circular area a few centimeters across, while retaining good energy resolution. (auth)

27652 SIMPLE OPEN BOOTH CLINICAL WHOLE BODY COUNTER. Gupta, M. M.; Jain, S. C.; Bhola, G. C. (Inst. of Nuclear Medicine and Allied Sciences, Delhi). Indian J. Radiol.; 25: No. 4, 274-279(Nov 1971).

The design features and sensitivity data of a prototype whole body counter for clinical applications set up at the Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi are reported. The counter is of the open booth type and uses the standard chair counting geometry modified to suit the Buddha posture. Its design takes into account the fact that the Indians are accustomed to sitting in a cross-legged position and hence it is suitable for clinical studies where the subject has to be in sitting posture for half an hour. The counter is shielded in a steel cubicle with its entry shielded by a lead screen. Its detector system consists of a NaI(Tl) crystal coupled with a photomultiplier tube. As in the Buddha posture the lower legs are practically at the same distance from the crystal as the other parts of the body and sensitivity and uniformity of spatial response are improved. The sensitivity data of the system are (i) background (integral counts above 110 keV) with shielding: 8275 ± 20 pm, (ii) background index: 7.32 cm/cc and (iii) background variation: not more than 8%. Values of the minimum detectable activity (MDA) and the minimum measurable activity (MMA) are tabulated for different radioisotopes. (INIS)

27653 USE OF A SOLUBILIZER-SCINTILLATOR MIXTURE FOR COUNTING AQUEOUS SYSTEMS CONTAINING HIGH- AND LOW-ENERGY RADIONUCLIDES. Handler, L. H.; Romberger, J. A. (Sun Oil Co., Marcus Hook, PA). Int. J. Appl. Radiat. Isotop.; 24: No. 3, 129-134(Mar 1973).

The liquid scintillation counting properties of several high- and low-energy radioisotopes in a proprietary solubilizer-scintillator mixture have been studied. Unquenched aqueous solutions of ^{14}C, ^{3}H, ^{65}Zn, ^{60}Co, ^{144}Ce, ^{133}Ba and ^{36}Cl were counted at reasonable efficiencies, and the effects of several quenching agents on counting efficiency were determined. The counting mixture, typical of several others also available, was more effective in solubilizing and counting large amounts of aqueous samples than a conventional dioxane based counting solution. The feasibility of using a solubilizer-scintillator mixture to count aqueous solutions of unconventional radioisotopes in a liquid scintillation spectrometer has been demonstrated. (auth)

27654 SUPPORT OF THIN WINDOWS FOR X-RAY PROPORTIONAL COUNTERS. Sheather, P. H. (University Coll., London). J. Phys., E (London); 6: No. 4, 319-322(Apr 1973).

A theoretical method is given for calculating the amount of support required for pressurized membranes of large breadth-to-thickness ratios. This theory has use in the design of windows for soft x-ray proportional counters. (auth)

27655 MODEL OF TEMPERATURE DEPENDENCE OF LATENT IMAGE IN PHOTOGRAPHIC EMULSIONS. Singh, M. (Government Higher Secondary School, Kurukshetra, India); Sharma, A. P. Indian J. Pure Appl. Phys.; 10: No. 9, 676-679 (Sep 1972).

A model of temperature dependence of latent image formation in AgBr crystals of photographic emulsion to understand the observed variation of the grain sensitivity with temperature has been proposed. The model based on the postulates of J. W. Mitchell [Rep. Progr. Phys., 20 (1957), 433] explains some features of the latent images formed when an emulsion is exposed to charged particles. (auth)

27656 USE OF AN IONIZATION CHAMBER PULSE IN THE SPECTROMETRY OF FISSION FRAGMENTS DURING OPERATION WITH A PULSED NEUTRON SOURCE. Akimov, Yu.; Antonova, N.; Bochvarov, S.; Dermendzhiev, E.; Kalinkova, N.; Kashukeev, N.; Shonova, N. Izv. Fiz. Inst. Aneb, Bulg. Akad. Nauk.; 22: 165-178(1972). (In Russian).

An ionization chamber for measuring kinetic energies of ^{235}U fission fragments is described. Preamplifier selection and target thickness parameters are discussed. (WHK)

27657 CORRECTIONS AT THE DETERMINATION OF SPECIFIC COUNTING RATES IN HOLLOW SCINTILLATORS RELATED TO EQUAL VOLUMES OF THE SAMPLES. Balla, B.; Rona, V. (MTA Izotop Intezete, Budapest). Izotoptechnika; 16: No. 11, 549-560(Nov 1972). (In Hungarian).

The relation between the counting efficiency and the sample volume for measurements in hollow crystals was studied, and functions for the determination of specific counting rates related to equal volumes are given. (auth)

27658 NEW TWO-CHANNEL SCANNER: SCINTIKART NUMERICK T. Billing, A. (Gamma Muevek, Budapest); Ambro, P.; Krasznai, I.; Foeldes, J. Izotoptechnika; 15: No. 11, 567-575(Nov 1972). (In Hungarian).

The new radioisotope scanner at Budapest is described. Double labeling, subtractive scintigraphy, automatic decay and background correction, and computerized data processing are discussed. (auth)

27659 NEW PARTICLE DETECTOR: THE CRYSTAL FILAMENT COUNTER. Pisarev, A. F.; Pisarev, V. F.; Revenko, G. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 63: No. 5, 1562-1575(Nov 1972). (In Russian).

A filament particle counter with gas, liquid or crystal filling is investigated. Operation is unstable if the counter is filled with pure gases such as argon, xenon, or methane, at high pressures. Mixtures of argon and methane yield satisfactory results up to pressures of 100 atm. Data on the characteristics of counters filled with liquid argon or xenon are given. Information is obtained on the operation of counters with liquid methane or liquid mixtures of methane and argon. Properties of a filament counter with crystal argon or xenon are investigated. The amplitude characteristics are found to possess three typical sections: the ionization, proportional (electron multiplication factor ~150), and saturation sections. The length of the counting plateau is ~3 kV. Satisfactory results were not obtained with crystalline methane. (auth)

27660 WINDOWLESS 4π-SCINTILLATION COUNTER WITH NaI(Tl) CRYSTALS. Pich, J.; Zderadicka, J.; Kokta, L. (Inst. for Research, Production, and Application of Radioisotopes, Prague). Radioisotopy; 13: No. 5, 903-923(1972).

The 4π-scintillation counter with the NaI(Tl) crystals of 4.3 cm diameter and 2 cm height is described. The source inside the polyethylene foil sandwich is inserted between the crystals. The efficiency is higher than 97% in the region from 20 to 160 keV when 20 mg/cm^2 foil is used. The counter has a good resolution and a low noise. When the emission rate of the 136 keV photons is measured the accuracy equals ±0.3% and in the case of the 22 keV photons, ±0.25%. (auth)

27661 MOBILE ^{41}Ar MONITOR. Saro, S.; Chudy, M.; Povinec, P. (Comenius Univ., Bratislava). Jad. Energ.; 19: No. 3, 92-94(Mar 1973). (In Slovak).

In nuclear reactors cooled by air or carbon dioxide an admixture of argon is present as an impurity in the coolant. Therefore the nuclear reaction of $^{40}Ar(n,\gamma)^{41}Ar$ takes place in the coolant. The product of this reaction is radioactive and there is a possibility of its leakage from the primary circuit of the reactor. A mobile monitor of argon-41 was constructed, the sensitivity of the device is 0.1 MPC. The use of an additional scaler enables detection of activities below 0.1 MPC. The 220 l flow chamber is monitored by two large area end-window Geiger–Mueller counters, which are able to detect selectively the beta radiation of ^{41}Ar present in the monitored air. (auth)

27662 INTRINSIC PLANE SENSITIVITY: A USEFUL PARAMETER FOR COMPARING RADIOISOTOPE SCANNERS. Sharma, R. R. (Post-Graduate Inst. of Medical Education and Research, Chandigarh, India). Int. J. Appl. Radiat. Isotop.; 24: No. 1, 62 (Jan 1973).

Further clarification is made of points made previously by the same author (Sharma, Phys. Med. Biol.; 16: 257 (1971) and Int. J. Appl. Radiat. Isotop.; 23: 121 (1972)) in answer to criticisms made by Barber (Int. J. Appl. Radiat. Isotop.; 24: 61 (1973)). The basis of the discussion is that the stationary detector head of a moving scanner does not function as a "scanner" and that a "functioning moving scanner" gets generated only when the head has "scanned" an area. The two systems are quite distinctly different in field properties, and as such, characteristic parameters of one cannot be extrapolated to describe the other. It is stated that Barber's argument is inconsistent with this and also within itself. (UK)

27663 CONTROL OF RADIOACTIVE CONTAMINATION OF EFFLUENTS BY MEASURING THE γ-ACTIVITY OF CONTAMINATING ISOTOPES. Viragh, E. (Budapesti Muszaki Egyetem). Izotoptechnika; 15: No. 7, 371-379(Jul 1972). (In Hungarian).

Instruments used for monitoring radioactive contaminants in effluents by measuring the γ-activity of contaminating isotopes are described. Application in monitoring of effluents from the radiochemical and physical laboratories attached to the training reactor of Budapest Polytechnical University is reported. (auth)

27664 METHODS USED FOR MEASUREMENTS OF ARTIFICIAL RADIOACTIVE AEROSOL CONCENTRATIONS EMITTING ALPHA AND BETA RAYS. Dvorak, V. (Research Inst. of Nuclear Instruments, Premysleni, Czech.). Jad. Energ.; 19: No. 3, 80-91(Mar 1973). (In Czech).

The radiometers used for the monitoring of artificial alpha and beta radioactive aerosols concentrations are defined and classified. The radiometers are divided into six groups according to the way applied for compensating the artifical radioactive aerosol influence. These methods are the following: simple detection, broad-channel analysis, pseudocoincidence, comparison method, combined method, as well as the laboratory process. The schematic diagram of electronic circuit wiring for every method is shown, together with the merits and demerits for each of the respective radiometers. In conclusion, there are shown the comparison calculations of radiometers for all of the 11 types from the standpoint of the background mean square error, supposing that the heating time of the steady values before starting the measurements lasts 2 h and that, moreover, some concrete conditions for the measurements are being adhered to. Calculations demonstrating the growth of natural alpha and beta activities on the filter and in such an extent which is judged suitable for the above mentioned comparison are given. Graphical demonstrations of the results enhance considerably the better comprehension of the possibilities and limits of singular methods. (auth) (34 references.)

27665 COMMENTS ON THE USE OF INTRINSIC PLANE SENSITIVITY AS A USEFUL PARAMETER FOR COMPARISON OF SCANNERS AND CAMERAS. Barber, D. C. (Weston Park Hospital, Sheffield, Eng.). Int. J. Appl. Radiat. Isotop.; 24: No. 1, 61(Jan 1973).

It is stated that the use of an "intrinsic plane sensitivity" as a parameter of comparison between rectilinear scanners and gamma cameras as suggested by Sharma (Int. J. Appl. Radiat. Isotopes; 23: 121 (1972)), is not the most useful for comparing these instruments and may lead to errors. It is shown that this parameter as defined by Sharma gives an over-estimate of the true sensitivity of a scanner relative to a camera. It is stated that Sharma's concept of the "working region" of the device is correct but that those of "counting area" and "counting time" appear to have little relevance to the problem of comparing the sensitivities of scanners and cameras. (UK)

Radiation Dosimeters

27666 (BRH-DEP-73-3, pp 39-94) PERSONNEL MONITORING. Rivkin, W. B. (Health Physics Associates, Highland Park, IL). Oct 1972.

Radiation safety and protection in industrial applications.

The development and characteristics of photographic film dosimeters are discussed. Topics include photographic response, exposure–density relation, dynamic range, energy response, directional dependence, fluctuations in film sensitivity and processing, temperature and humidity effects, film neutron monitoring, and charged particle track monitoring. Advantages and sources of error in film dosimetry are listed. Also, other dosimetry systems are reviewed including ion chamber pocket dosimeters, Geiger–Mueller personnel monitors, RPL dosimeters, and thermoluminescent dosimeters. (33 references) (WHK)

27667 INVESTIGATION ON TRACK FADING IN KODAK PERSONAL NEUTRON MONITORING FILMS TYPE A. Jasiak, J.; Musialowicz, T. (Central Lab. for Radiological Protection, Warsaw). Nukleonika; 17: No. 12, 647-653(1972).

Investigation on track fading was carried out using Type A Kodak Personal Neutron Monitoring Films currently in use in fast neutron monitoring service at the Central Laboratory for Radiological Protection. The tests conducted were related to the kind of wrapping, climatic conditions of exposed film storage, as well as the prior desiccation of films before irradiation. On the basis of the test results, a one-month monitoring period has been adopted. Taking into account the track fading in the monitoring period adopted, a correction factor of 1.2 has been introduced in the assessment of neutron dose equivalent. (auth)

27668 PERSONNEL IONIZATION DOSIMETERS ESPECIALLY FOR RADIATION OF UNKNOWN COMPOSITION. Zielczynski, M. U. S. Patent 3,719,826. 6 Mar 1973. Priority date 27 Aug 1968, Poland. 4p.

A personal ionization dosimeter comprising a group of three individual dosimeters each including an annular voltage electrode defining a housing and a cylindrical test electrode is described. The ratio of the radius of the active surfaces of the electrodes does not exceed 2.5. An auxiliary electrode is provided and a supply capacitor is connected across the auxiliary and voltage electrodes. The dosimeters are filled with a mixture of propane (55%), carbon dioxide (41%) and nitrogen (4%) at a pressure of 28 to 85 lb/sq. in. One dosimeter has a voltage of 40 V and the other two a voltage of 800 V. (Official Gazette)

27669 INVESTIGATION OF DOSE FIELDS OF A CLINICAL PROTON BEAM BY MEANS OF X-RAY DEFECTOSCOPIC TRACK DETECTORS. Lomanov, M. F.; Shimchuk, G. G.; Yakovlev, R. M. At. Energ. (USSR); 34: No. 3, 185-190(Mar 1973). (In Russian).

An application of x-ray defectoscopic track detectors for the measurement of dose distributions in clinical proton beams for therapy and neurosurgery is described. The method is based on the count of ^{238}U fission fragments producing damage tracks in a glass plate. Absorbed dose distributions in narrow beams are obtained with a resolution close to 0.2 mm. For dose measurements outside the beam, where a significant neutron background is present, it is shown that the number of fission fragments per cm^2 is nearly proportional to an equivalent dose (i.e., in terms of man roentgen-equivalent — rem) over a wide range of proton and neutron energies. (auth)

27670 CALCULATION OF IONIZATION CHAMBER COLLECTION EFFICIENCY FOR PULSED BEAMS. Armstrong, D. I. (Christchurch Hospital, New Zealand). Phys. Med. Biol.; 18: No. 2, 293-295(Mar 1973).

A simple graphical method of estimating ionization chamber collection efficiency is outlined. This correction is necessary in radiotherapy departments where x-ray or electron generators are used clinically under conditions approaching ion current saturation A graph is presented for a Baldwin–Farmer dosemeter used for 5 MeV electron dosimetry. (UK)

27671 ROUTINE MEASUREMENTS OF OPTICAL ABSORPTION AT 224 AND 304 nm TO DETECT IMPURITIES IN FRICKE DOSIMETRY. Denman, A. R. (Royal Free Hospital, London). Phys. Med. Biol.; 18: No. 2, 291-293(Mar 1973).

Nine Fricke standard dosemeter solutions were separately prepared, given a dose of ~7 krad of 230 keV x-rays, and the change in optical density at 224 and 304 nm measured. For one of the solutions, the ratio of the density at the two peaks differed significantly from those of the other solutions, which gave values close to those previously reported for ratio of the absorption coefficient (0.481). Similar results were obtained when the anomalous solution was irradiated with Cs γ-rays, giving a ratio of 0.534. The absorption of the unirradiated anomalous solution compared with that of water was small over the range 220 to 320 nm, but increased markedly for the shorter wavelengths, rising to an absorbance of 0.72 in a 1 cm cell at 200 nm, much greater than for the other solutions. A similar effect was produced by immersing a paper clip in a normal solution for 24 hr before radiation, and a decrease of the ratio was produced by addition of lithium fluoride to 0.406. In no case where the ratio of the absorption peaks differed significantly from normal did the absorption measured at 304 or 224 nm approach within 10% of the value for a pure solution. When the ratio was significantly roused, the optical absorption of the unirradiated solution read against distilled water was increased at 200 nm. (UK)

27672 THERMOLUMINESCENT DOSIMETRY FOR FAST NEUTRON BEAMS USING CaF_2:Mn. Blum, E.; Bewley, D. K.; Heather, J. D. (Hammersmith Hospital, London). Phys. Med. Biol.; 18: No. 2, 226-234(Mar 1973).

Calcium fluoride (Mn) Teflon thermoluminescent dosimetry (TLD) has been used for dosimetric studies of the fast neutron beam from the MRC Cyclotron. The very small intrinsic sensitivity of this phosphor to fast neutrons makes it suitable for investigating the gamma contribution in the field. The percentage of dose due to γ-rays was found to be 5% in reasonable agreement with a measurement of 3% using photographic film. Exposures in pairs, one in an hydrogenous medium (polythene), the other in lead, enable the gamma and neutron components to be measured separately. This method has been applied to depth dose studies in tissue-equivalent phantoms. The dosemeters are discs 0.13 × 6.0 mm and the readout instrument used was a Conrad Type 5100. Reproducibility of 3% has been obtained using a controlled calibration and annealing technique. The angular response severely limits its application in clinical use. (auth)

27673 DIFFUSE REFLECTANCE DOSIMETRY. Kushelevsky, A. P. (Institut de Radiophysique Appliquee, Lausanne, Switzerland). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 127-128(Feb 1973).

The formation of free radicals in irradiated powdered amino acids and dipeptides can be used as a method of γ and x-ray dosimetry by observing the free radicals using reflectance spectrometry. Diffuse reflectance bands are formed in the near uv region. The spectrum of irradiated glycyl-glycine after a dose of 2.5 MR ^{60}Co γ radiation is shown. The new bands formed after irradiation are stable both in shape and in intensity over prolonged

periods. The band peak changes as a function of dose and thus a calibration curve can be used for dosimetry. The advantages of diffuse reflectance dosimetry are given but it is emphasized that the method is many orders of magnitude less sensitive than the more sophisticated esr dosimetry. It is however particularly suited for measuring doses above 0.5 MR with an accuracy of ±5%. (UK)

27674 ALARM RADIATION DOSIMETER WITH IMPROVED INTEGRATING PULSE IONIZATION CHAMBER AND HIGH VOLTAGE SUPPLY. Borkowski, C. J.; Rochelle, J. M. (to United States Atomic Energy Commission). U. S. Patent 3,711,705. 16 Jan 1973. Filed date 9 Nov 1971. 6p.

An alarm dosimeter which features an improved integrating pulse ionization chamber of the type containing an hermetically sealed gas diode is described. Improved operation and miniaturization of the chamber are made possible by a ringing choke converter high voltage supply having a ripple-type output that insures discharge of the gas diode. (Official Gazette)

27675 VACUUM RADIATION ELEMENTS FOR MEASUREMENT OF HIGH INTENSITY γ RADIATION EXPOSURE DOSE. Mukhachev, B. V.; Pushkarev, A. V.; Samoylov, P. S. Tr. Soyuznogo Nauch.-Issled. Inst. Priborostr.; No. 17, 63-71(1972). (In Russian).

The design, calibration, and results of testing of vacuum radiation γ elements for measurements of high-intensity γ radiation exposure doses, requiring no external power supplies, are described. The diameter of the sensing portion of the γ element is 6 mm, length 150 mm. It is shown that the sensitivity of γ elements is higher, the greater the difference in atomic numbers of the emitter and (stainless steel) collector materials. The sensitivity of the γ elements with emitters of zirconium and tantalum are $1.5 \cdot 10^{-13}$ and $6 \cdot 10^{-13}$ A/R/s respectively. Results are presented from tests of γ elements in the SM-2 reactor. It is shown that γ elements can be used between 10^3 and 10^6 R/s at temperatures of up to 500°C. The output signals of the γ elements are proportional to the reactor power and are independent of temperature, while the resistance of the insulation of the γ element under actual operation conditions is at least 10^7 ohm. (JPRS)

27676 DETERMINATION AND INTRODUCTION OF THE R-UNIT BY DAMW. Part 1. Outdoor Ionization Chambers for X Radiation with the Excitation Potential Ranging Between 6 to 400 kV. Rothe, H.; Willuhn, K. (Deutsches Amt fuer Messwesen und Warenpruefung, Berlin). Isotopenpraxis; 8: No. 8, 281-293 (Aug 1972). (In German).

In order to secure uniformity and accuracy of dose measurement, direct or indirect checking of dosemeters by means of suitable standard meters has been developed. Information is supplied on the standard ionization chambers developed for the determination and introduction of the R-unit for x and gamma radiation. Part 1 deals with the outdoor ionization chambers measuring x radiation with the excitation potential ranging from 6 to 400 kV. It consists of three parallel-plate chambers designed to meet the demands and to render possible absolute dose measurements with maximum measuring error between 1.1 and 1.5%. Monitor chambers in the shape of flat-type transirradiation ionization chambers showing little dependency of their sensitivity from the energy serve as transfer normal. Both the design and the principle of operation as well as the mode of determining the correction factor entering the measurement result are presented in detail. (auth)

27677 PLOTTING AND PROPAGATION OF THE EXPOSURE UNIT ROENTGEN IN THE DAMW. II. Cavity Ionization Chambers for the γ-Radiation of ^{60}Co and ^{137}Cs. Hecker, O.; Rothe, H. (Deutsches Amt fuer Messwesen und Warenprufung, Berlin). Isotopenpraxis; 8: No. 10, 373-379(Oct 1972). (In German).

The first part of the work provided a description of DAMW standard measuring devices (free-air ionization chambers) used for plotting the exposure unit for energy in the x-ray range. The present work deals with the corresponding devices for the gamma-radiation of ^{60}Co and ^{137}Cs. Various extra-pure graphite cavity ionization chambers serve as a basis for the determination of the unit according to definition. They are of the cylindrical type having measuring volumes of about 2 cm^3, 8 cm^3, 30 cm^3, or 100 cm^3 respectively. An electrometric photoelectric-type potentiometer is used as a charge measuring device, too. Determination of correction factors to be applied to collimated beams is dealt with in detail. The maximum error arising with the plotting of the exposure unit ranges 2 per cent. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 28418, 29005, 29027, 29067, and 29149.

27678 (CONF-720908-, pp 100-107) PERFORMANCE OF THE FIRST QDDD SPECTROGRAPH. Goldschmidt, M.; Rieck, D.; Wiedner, C. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A new type of magnetic spectrograph for precision spectroscopy of charged particles from nuclear reaction has been put into operation. This spectrograph consists of a quadrupole followed by three dipoles, a multipole element and an electrostatic deflector. The ion optical lay-out features a point to point image in both planes and in addition an axial intermediate image. The components of the system have been mapped. After assembling, the spectrograph has been ray traced with ^{3}He particles of 24 MeV. The resolving power at the full solid angle of 13 msr is $dp/p \cong 10^{-4}$ for several reactions investigated so far. (auth)

27679 (CONF-720908-, pp 578-584) PROBLEMS ASSOCIATED WITH ATTAINING HIGH FIELD UNIFORMITY AND REPRODUCIBILITY IN MAGNETIC SPECTROGRAPHS. Enge, H. A. (Massachusetts Inst. of Tech., Cambridge); Kowalski, S. B.; Wiedner, C. A.; Goldschmidt, M.; Scheerer, H. J. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Precision magnetic spectrographs require a very high degree of reproducibility of the field over relatively large pole areas. For homogeneous field magnets (n = 0), three design principles have long been recognized: (a) The return path should be balanced as well as possible around the magnet; (b) the pole pieces should have Rogowski tapering around the complete periphery; and (c) Purcell filters (homogenizer gaps) should be used. It has been recognized lately that the most nearly perfectly designed magnet still exhibits quite large changes in field distributions, presumably because of hysteresis effects caused by eddy currents in the pole pieces. Efforts to minimize these effects by (1) programming the power supply to follow a prescribed current-versus-time curve and (2) using higher permeability materials are discussed. (auth)

27680 (CONF-720908-, pp 801-807) DESIGN AND CONSTRUCTION OF MAGNETIC MEASUREMENTS IN A HIGH PERFORMANCE SPECTROMETER MAGNET. Turck, B. (CEN, Saclay, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The influence of every kind of measuring error was tested directly on the image through a trajectory program. This work points out on which parts of the equipment the accuracy must be high or may be low. A Hall probe system was built to measure the field map of the 1 GeV spectrometer magnet. At 0.4 mm image width was achieved after shimming, that is to say an overall accuracy better than 10^{-4} for $\Delta p/p_0$. (auth)

27681 DIGITAL SINE GENERATOR FOR MOESSBAUER SPECTROMETERS. Halder, N.; Kalvius, G. M. (Technical Univ., Garching, Ger.). Nucl. Instrum. Methods; 108: No. 1, 161-165(1973).

A sine generator for a velocity sweep Moessbauer spectrometer is described. It delivers a sine as the reference voltage for the electromechanical drive unit together with phase locked channel advance pulses for multiscaler operation of the multichannel analyzer. The sine function is generated digitally by a commercial MOS read-only memory in connection with a digital to analog converter. The resolution of the generator is 11 bits for a quarter period giving rise to a sine wave of very low distortion. A simple feedback circuit for the operation of the velocity transducer is also described. (auth)

27682 POLAR COORDINATE X-RAY GRATING SPECTROMETER. Franks, A.; Stedman, M.; Braybrook, R. F. (National Physical Lab., Teddington, Eng.). J. Phys., E (London); 6: No. 3, 233-236(Mar 1973).

A new principle applicable to the Rowland circle mechanisms of x-ray spectrometers is formulated, and is based on the geometry of the circle considered in terms of its polar coordinates relative to the pole of the grating. It allows continuous adjustment of the Rowland radius scanned; it confers flexibility in operation, yet simplifies construction of the instrument. A soft x-ray spectrometer, designed on the new principle, is described and covers the wavelength range 1 to 20 nm for concave gratings of any radius between 0.5 and 5 m. Results obtained using an electron microprobe source are presented. (auth)

27683 HIGH-PURITY GERMANIUM γ-RAY SPECTROMETERS WITH Al REGROWTH p^+ CONTACTS. Marrello, V.; McMath,

T. A.; Mayer, J. W.; Fowler, I. L. (Chalk River Nuclear Labs., Ont.). Nucl. Instrum. Methods; 108: No. 1, 93-97(1973).

Solid-phase regrowth processing has been used to fabricate large area (5 cm^2), thin p^+-contacts on high purity germanium. Evaporated Al layers on Ge were heated at 300°C and slow-cooled to form the p^+-contacts. The n^+-contacts were formed by lithium diffusion. Detector resolutions of ≲1 keV for ^{57}Co and ≈2 keV for ^{60}Co are comparable to those obtained with Ge(Li) detectors of similar size with the same electronic system. (auth)

27684 PLANAR RETARDING GRID ELECTRON SPECTROMETER. Helmer, J. C. (to Varian Associates). U. S. Patent 3,710,103. 9 Jan 1973. Filed date 3 Dec 1971. 10p.

A retarding grid form of electron spectrometer utilizing a single grid structure, the retarding grid being planar and being positioned in a focusing structure that first defocuses the beam of electrons and then refocuses it onto an electron detector is described. The retarding grid is located in the focusing structure near the point of maximum diameter of the electron beam. The focusing structure produces very strong accelerating and decelerating fields near its beam entrance and exit regions, respectively, such that the retarding and accelerating fields at the retarding grid are very weak, resulting in sharp lines in the electron spectrum. (Official Gazette)

27685 MOBILE GAMMA SPECTROMETER AGS-3M. Bogaevskii, Yu. G.; Stepanov, V. B.; Filimonov, V. V.; Fogt, P. N. Geofiz. App.; No. 49, 59-61(1972). (In Russian).

A gamma spectrometer (AGS-3M) was designed to be mounted on an automotive-powered chassis for field use in assaying rock samples for radioactive elements. A block diagram is presented and discussed. The thresholds of sensitivity for U, Th, and K in four types of minerals and rocks are tabulated. (KSW)

27686 SYSTEM FOR STABILIZING THE AMPLIFICATION FACTOR OF A GAMMA SPECTROMETER. Danilov, V. S.; Filimonov, V. V. Geofiz. App.; No. 49, 51-55(1972). (In Russian).

A system was developed for automatic stabilization of the gain of a four-crystal spectrometer which used ^{60}Co γ radiation as an external standard. The reference signal from the total spectrum was segregated by means of β-γ-coincidence. The stabilizing system held the amplifier error to 1% during voltage changes of ±90 V from the normal value. The amplifier gain did not vary over ±0.25% from its average value despite a change in temperature over the range from 278 to 313°K. During a two-month field service of the γ-spectrometer the amplification held to ±0.5%, and the energy resolution was preserved within the limits 11.7 ± 0.1% based on ^{65}Zn. (tr-auth)

27687 FLUORESCENCE ANALYSIS USING AN Si(Li) X-RAY ENERGY ANALYSIS SYSTEM WITH LOW-POWER X-RAY TUBES AND RADIOISOTOPES. Dyer, G. R.; Gedcke, D. A.; Harris, T. R. (ORTEC, Inc., Oak Ridge, TN). Advan. X-Ray Anal.; 15: 228-239(1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

The development, operation, and detectability limits of various radioisotope x-ray sources and tube-type x-ray sources used with Si(Li) detectors for fluorescence analysis are discussed. (WHK)

27688 USE OF A SOLID-STATE DETECTOR FOR THE ANALYSIS OF X RAYS EXCITED IN SILICATE ROCKS BY ALPHA-PARTICLE BOMBARDMENT. Franzgrote, E. J. (California Inst. of Tech., Pasadena). Advan. X-Ray Anal.; 15: 388-406 (1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

The analysis of alpha-excited x-rays has been studied as a possible addition to the alpha-scattering technique used on the Surveyor spacecraft for the first in situ chemical analyses of the lunar surface. Targets of pure elements, simple compounds, and silicate rocks have been exposed to alpha particles and other radiation from a curium-244 source and the resulting x-ray spectra measured by means of a cooled lithium-drifted silicon detector and pulse-height analysis. Relative efficiencies of x-ray excitation by alpha particles and by x-rays from the curium source have been determined. Resolution of the detector system used is approximately 150 eV for the lighter elements. This is sufficient to resolve the Kα x-rays of the geochemically important elements, Na, Mg, Al, and Si in silicate rocks. The study shows that the addition of an x-ray mode to the alpha-scattering analysis technique would result in a significant improvement in analytical capability for the heavier elements. In particular, important indicators of geochemical differentiation such as K and Ca (which are only marginally separated in an alpha-scattering and alpha-proton analysis) may be determined quantitatively by measuring the alpha-excited x-rays. An x-ray detector is under consideration as an addition to an alpha-scattering instrument now under development for possible use on a Mars-lander mission. (auth)

27689 DETECTOR BACKGROUND AND SENSITIVITY OF SEMICONDUCTOR X-RAY FLUORESCENCE SPECTROMETERS. Goulding, F. S.; Jaklevic, J. M.; Jarrett, B. V.; Landis, D. A. (Univ. of California, Berkeley). Advan. X-Ray Anal.; 15: 470-482(1972).

From twentieth annual conference on applications of x-ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

Degraded detector pulses are shown to contribute most of the background in spectra produced by semiconductor-detector x-ray spectrometers. A new guard-ring detector is used with appropriate circuits to reduce background by a large factor. The sensitivity of the new arrangement with various excitation sources is discussed. (auth)

27690 HIGH-RESOLUTION Si(Li) SPECTROMETER AND ITS ANALYTICAL APPLICATIONS. Lal, M.; Kapoor, S. S. (Bhabha Atomic Research Centre, Trombay, India). pp 503-510 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

27691 MODIFICATION OF THE SIEGBAHN–SLATIS BETA-RAY SPECTROMETER FOR BETA–GAMMA COINCIDENCE STUDIES. Ravindranath, M.; Narasimha Rao, C.; Venkata Reddy, K. (Andhra Univ., Waltair, India). pp 511-514 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

27692 GAMMA-RAY ENERGIES MEASURED WITH Ge(Li) SPECTROMETER. Helmer, R. G.; Greenwood, R. C.; Gehrke, R. J. (Aerojet Nuclear Co., Idaho Falls, Idaho). pp 112-122 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A study to measure and compare gamma-ray energies over an energy range of 50 keV to 11 MeV is reviewed including the data analysis procedures that can be used with data from Ge(Li) spectrometers. The uncertainties in the energy scales that are commonly used and their compatibility are discussed. Techniques which can be used for this work are considered; and examples of results obtained up to 3500 keV given. Steps that may lead to significant reduction in the uncertainties in the gamma-ray energies are noted. Comments are made on the problems in the use of double-escape peaks and on the probable precision obtainable in the few MeV region. (UK)

27693 MEASUREMENT OF (n,γ)-LINES WITH A HIGH RESOLUTION DUMOND-TYPE DIFFRACTOMETER. Schult, O. W. B.; Koch, H. R.; Baader, H. A.; Breitig, D. (Technische Univ., Garching, Ger.). pp 123-130 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A rélatively small Dumond-type X-ray diffractometer, that is, one which has a cylindrically bent focussing crystal the efficiency of which is about three orders of magnitude larger than that of a flat crystal, has been used to measure many (n,γ) spectra in the period 1962–1970. The diffractometer and its characteristics are discussed and compared with Ge(Li) and Si(Li) spectrometers. Results are given of low-energy γ spectra measurements from slow-neutron capture in a number of isotopes. The evaluation and nuclear structure interpretation of several of the obtained spectra have been completed. The main interest of these (n,γ) studies has been the investigation of the structure of the observed levels to refine the present nuclear models. (UK)

27694 ELECTRON SPECTROSCOPY AND THE FINE STRUCTURE CONSTANT. Jennings, J. C. E. (Birkbeck Coll., London). pp 379-385 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A method of using an absolute electron spectrometer (Siday, R. E.; Proc. Phys. Soc.; 54: 266 (1942)) based on the image rotation produced by a magnetic lens is proposed to contribute to the knowledge of $\lambda_c = h/mc$, the Compton wavelength of the electron (and hence the fine structure constant). The special features of the spectrometer and possible sources of error are discussed. Some preliminary results are given. (UK)

27695 SOME PRACTICAL ASPECTS OF SEMICONDUCTOR GAMMA SPECTROMETRY IN UVVVR. Kokta, L. (Inst. for Research, Production, and Application of Radioisotopes, Prague); Hospes, M.; Novotna, P.; Vicek, J. Radioisotopy; 13: No. 5, 925-932(1972). (In Czech).

Some experiences are reported obtained with gamma spectra processing by Ge(Li) semiconductor detectors with the use of the computers IBM 360/40 and Varian 620-L. The influence of the counting rate on the photopeak configuration, the determination of the absolute counting efficiency, and the sample size are described. (auth)

27696 AUTOMATIC GAMMA SPECTRUM LINE FINDING. Kristak, J. (Fyzikalny Ustav, Bratislava). Radioisotopy; 13: No. 5, 933-939(1972). (In Slovak).

A method of automatic finding of lines in a gamma spectrum is discussed, based on a cross-correlation function enabling the separation of the signal from the statistical noise. The advantages of the algorithm of line finding, including a suitable cross-correlation function, are emphasized. (auth)

27697 PHOTOMULTIPLIERS FOR NUCLEAR SPECTROMETRY. Raus, J.; Beranek, I. (Tesla-VUVET, Prague). Radioisotopy; 13: No. 5, 941-956(1972). (In Czech).

A short survey is presented of the Czechoslovakia production of photomultipliers for nuclear spectrometry applications. The basic parameters of three categories of photomultipliers are described for photocathode diameters 25 mm, 45 mm and 110 mm and the trend of future development is outlined aiming at amplification increase and noise reduction. (auth)

27698 GAMMA SPECTROMETER DEAD-TIME CORRECTION FOR THE MEASUREMENT OF SHORT-LIVED RADIONUCLIDES. Bartosek, J. (Inst. of Applied Geophysic, Brno); Kasparec, I.; Masek, J.; Adams, F.; Hoste, J. Radioisotopy; 13: No. 5, 977-980(1972). (In Czech).

The method is based on the generation of an additional dead time on the end of very short measuring intervals in order to keep the total dead time of the gamma spectrometer constant over the whole measurement time. The device was checked in measurements of high-activity solutions of reactor-irradiated samples of indium. (auth)

27699 AUTOMATIC GAMMA-SPECTROMETRIC ANALYSIS. Kapisovsky, V.; Trhlik, J. Radioisotopy; 13: No. 5, 981-1006 (1972). (In Slovak).

The structure of a gamma-spectrometric system is briefly described and the format of the output data is discussed. The methods of data preparation on punched tape for automatic processing and the SPAN program for spectra evaluation on the TESLA 200 computer are described. Also, the energetic and effective calibration function and identification of radioisotopes using the least squares method and the isotope reference catalog is discussed. (auth)

27700 SET OF PROGRAMS FOR PROCESSING OF EXPERIMENTAL DATA OBTAINED WITH METHODS OF GAMMA-SPECTROMETRY. Rikovska, J.; Zvolska, V.; Knatowicz, V. Radioisotopy; 13: No. 5, 1007-1023(1972). (In Czech).

A universal system of programs is described for computer processing of gamma spectra, determination of gamma transition energies and intensities, and assessment of the most probable scheme of excited levels in the isotope investigated. The set of programs is well suited for a rapid evaluation of a large quantity of experimental data both in the fields of nuclear gamma spectroscopy and activation analysis. (auth)

27701 STABILITY OF SCINTILLATION SPECTROMETERS AND RADIOMETERS WITH CZECHOSLOVAK LARGE-VOLUME SCINTILLATION DETECTORS AND EVALUATION DEVICE TESLA IN CONTINUOUS OPERATION. Silar, J.; Andrle, J. Radioisotopy; 13: No. 5, 1025-1067(1972). (In Czech).

The effects of (a) the change of electrostatic field distribution between electrodes due to the photomultiplier potential difference; (b) the change of cesium concentration on the surface of diodes due to diffusion of ionized atoms through the semiconductive layers under the influence of the electrostatic field; and (c) the temperature dependence of the luminescent efficiency of NaI(Tl) crystals and overall sensitivity of the 65 PK 423 photomultipliers on the signal pulse height and the output of large-volume detectors in short and long time operation are reported. The measurement results of long term stability of the signal pulse height and the sensitivity stability in the integral and photopeak performance of large-volume detectors with ϕ 100 × 120 mm NaI(Tl) crystals and with 65 PK 423 photomultipliers in connection with the evaluation set TESLA NZG 312 T are described. (auth)

27702 DETERMINATION OF PEAK AREA. Kokta, L. (Inst. for Research, Production, and Application of Radioisotopes, Prague). Radioisotopy; 13: No. 5, 881-902(1972).

A view of methods for peak area determination by scintillation and semiconductor spectrometers is given. Methods employing measured values directly or taking advantage of fitted approximative functions are presented. The course and approximation of the background under the peak are discussed with regard to accuracy. Some practical aspects which may significantly increase the determination error are reported. On the basis of the data for real situations it is possible to propose the most advantageous method for determination of peak area with a sufficient accuracy. (54 references.) (auth)

High Energy Physics Instrumentation

27703 (CONF-720908-, pp 108-113) STUDY AND CONSTRUCTION OF TWO HIGH-PERFORMING MAGNETS FOR 1.7 GeV/c SPECTROMETER. Ohayon, M.; Penicaud, J. P.; de Sereville, B. (CEN, Saclay, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Two high performing spectrometer magnets, window-frame type with azimuthal fringing field magnetic radius have been studied, built and measured. The two-dimensional computer program "MARE-C" gives an accurate knowledge of the magnetic field, especially of the effects of the coils real structure, and its errors of construction and location. The magnetic study of the azimuthal fringing field with the same two-dimensional program "MARE-C" in connection with measurements on a similar aperture magnet gives a method to compute the fringing field with infinite and finite magnetic radius with and without clamp field and with and without shims. The fringing field magnetic radius can be determined better than 1%. (auth)

27704 (CONF-720908-, pp 295-300) PRELIMINARY TEST RESULTS OF BEBC SUPERCONDUCTING MAGNET. Wittgenstein, F. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The general lay-out of the Big European Bubble Chamber (BEBC) is given. The magnet surrounds the chamber which has a capacity of 35 m^3 of liquid hydrogen. Producing a central field of 3, 5 T, it consists of two coils inserted in two annular cryostats mounted in their own vacuum tank. The whole system is enclosed by a magnetic shield to reduce the stray field. The geometrical data of the coils are given. The design parameters and results of preliminary tests are given. (WHK)

27705 (CONF-720908-, pp 328-333) OPERATION AND ACCURACY OF THE 12-FOOT BUBBLE CHAMBER MAGNET. Jaeger, K.; Purcell, J. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Between December 1968 and March 1972, the superconducting 12-foot bubble chamber magnet has been cooled down seven times. Within this time, the magnet was kept full of liquid helium for ~15 months of which more than six months had the coils energized for fields between 10 and 18 kG. Throughout the actual runs of the bubble chamber, the magnet has proven itself as being extremely reliable without causing any major upsets in the overall system. The magnetic field has been mapped at 10, 15 and 18 kG using flip coils and NMR probes. Consequent fitting of the measured field variables yielded polynomials which reproduce the mapped fields to within 0.1 %. Reproducibility and uniformity of the fields have been checked several times. The values agreed to within the measured accuracy. Fits to the K^0 meson yielded a mass of 497.6 ± 0.3 MeV which is in excellent agreement with world averaged data and thereby confirms the accuracy of the used magnetic field maps. (auth)

27706 (CONF-720908-, pp 450-455) HIGH MAGNETIC FIELD LABORATORY, RRE MALVERN. Parkinson, D. H.;

Harris, A. G.; Stearn, J. W. (Royal Radar Establishment, Malvern, Eng.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Recent developments in the RRE High Field Laboratory are described. A comprehensive range of Bitter Solenoids has been designed and is working with high reliability. Examples of standard fields are 155 kG in a 33 mm clear bore at 3.81 MW, and 86 kG in a 140 mm clear bore at 4.16 MW. A series transistor magnet current stabiliser, designed to handle 3.5 MW at 14,000 A from a transformer/rectifier set, has been devised. Established permanent facilities for magneto-optical studies are outlined as are those for short-sample hard-superconductor tests. The evaluation of conduction and constructional materials for RHEL's superconducting bubble chamber has been a recent item of work. A Niobium–Titanium solenoid for working at 84 kG has been successfully tested and proved. Stainless steel AISI 316 (LN) has been shown to be a first choice for "Cryo-Magnetic" enclosures. (auth)

27707 (FRNC-R-16, pp 145-150) 300 GeV SPECTROMETRY, Ω SPECTROMETER. Gouanere, M. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

Some of the information made available during three recent meetings concerning high energy spectrometer projects is presented: session of the ECFA on Ω spectrometry (12/14/71); CERN seminar on high energy Ω (2/4/72); and meeting at Orsay organized by the French members of the ECFA executive Committee (2/22/72). The principal experimental difficulty resides in the energy resolution. Studies of Ω with BEBC are more advanced as precisely defined experimental projects are not required. (FR)

27708 (IFVE-SEF-72-13) MEMORY MATRIXES WITH FERRITE CORES FOR WIRE SPARK CHAMBERS. Karpekov, Yu. D.; Konstantinov, V. F.; Makarov, G. P.; Prokhorov, A. N.; Simonov, Yu. N. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1972. 8p. (In Russian). INIS.

The preparation of ferrite memory matrices for wire spark chambers is discussed. The difficulty of matrix fabrication was reduced by a factor of ten as contrasted to the completely manual techniques employed, due to the mechanization of the piercing operation for the windings. The mechanical design of the device is described. (tr-auth)

27709 (IFVE-SUM-71-31) DETERMINATION OF THE OPTICAL CONSTANTS FOR BUBBLE CHAMBERS (PYTHON PROGRAM). Klimenko, S. V.; Rybin, A. M. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1971. 16p. (In Russian). INIS.

The calculation of optical constants of bubble chambers was introduced into the program for a processing system of information derived from film. The program was related to the PYTHON program from the library program of CERN TC LIBRARY as written in Fortran and adapted for the computer BESM-6. The method of determining the optical constants is described as used in this program. (tr-auth)

27710 (LAL-RI-72-7) STUDY OF DISTORTIONS INTRODUCED BY THE OPTICAL SYSTEM OF THE GARGAMELLE BUBBLE CHAMBER. Pascaud, C.; Heusse, P.; Vialle, J. P. (Paris Univ., Orsay (France). Ecole Normale Superieure). Oct 1972. 25p. (In French). Dep. NTIS (U. S. Sales Only) $3.25.

Distortions introduced by the Gargamelle optical system were determined from grid measurements effected with an optical bench at CERN. Since these measurements were made in air, corrections are introduced to allow for the refractive index of the liquid. In addition, the re-focusing between the moment when these measurements were made and the moment of the photographic exposure necessitates the application of the vehicle correction (Price data). (FR)

27711 1-ATM GAS CHERENKOV COUNTER WITH LARGE PHASE-SPACE ACCEPTANCE. Cence, R. J.; Harris, F. A.; Jones, B. D.; Morgado, R. E.; Shiraishi, L. M.; Yount, D. E. (Univ. of Hawaii, Honolulu). Nucl. Instrum. Methods; 108: No. 1, 113-118(1973).

A matched pair of threshold gas Cherenkov counters is described. Each module subtends an angular acceptance nominally 25° by 25° and has an entrance aperture 130 cm wide and 110 cm high. The use of four 60AVP photomultipliers with 20-cm diameter photocathodes permits effective light collection over a gas volume exceeding 10 m^3 per counter. The mean efficiency measured for beam electrons incident with well-defined trajectories is (92.5 ± 0.7)%, while the average efficiency in a recent $K^+_{\mu 4}-K^+_{e e e}$ experiment is in the range 66 to 85%, as deduced from two analyses of data samples for which the decay electrons have phase volumes exceeding the nominal acceptances by at least a factor of two. (auth)

27712 BROOKHAVEN DOUBLE VEE MAGNETIC SPECTROMETER. Foley, K. J. (Brookhaven National Lab., Upton, NY); Love, W. A.; Ozaki, S.; Platner, E. D.; Saulys, A. C.; Willen, E. H.; Lindenbaum, S. J. Nucl. Instrum. Methods; 108: No. 1, 33-60 (1973).

A technical description of the Brookhaven Double Vee Magnetic Spectrometer is presented. The performance of this spectrometer in the study of high-energy interactions is discussed. (auth)

27713 RADIATION INDUCED COLORING OF CHERENKOV COUNTER GLASSES. Goldberg, M.; Mattern, P. L.; Lengweiler, K.; Levy, P. W. (Brookhaven National Lab., Upton, NY). Nucl. Instrum. Methods; 108: No. 1, 119-123(1973).

The radiation induced absorption, i.e., coloring, has been determined for two lead silicate glasses used in Cherenkov counters. The measurements were made on Schott SF5 and Ohara PEMG4 glasses. Both the radiation induced absorption spectra and the coloring, or growth curves of the two glasses are quite similar. The absorption of both glasses extends from the ultraviolet "edge" to the near infra-red and can be resolved into three broad Gaussian shaped bands. The growth of two of the bands is accurately described by the expression $\alpha(\Phi) = A(1 - e^{-a\Phi}) + \alpha_L\Phi$ where Φ is the total dose imparted to the glass and A, a and α_L are constants which are different for each band. The constants specifying the growth curves and the absorption bands have been determined. Thus, the radiation induced absorption in these glasses can be computed if the dose rate and irradiation time or total dose is known. (auth)

27714 CHARACTERISTICS OF A CAPACITY READ-OUT SPARK CHAMBER. Arnison, G. T. J. (Rutherford High Energy Lab., Chilton, Eng.). Nucl. Instrum. Methods; 108: No. 1, 135-138(1973).

The design and initial performance results are described for a capacity-type readout system for spark chambers operating in strong magnetic fields. (WDK)

27715 AUTOMATIC MEASUREMENT OF STREAMER CHAMBER PICTURES. Eggert, K.; Guerich, W.; Moze, W.; Stolze, C. (Technische Hochschule, Aachen). Comput. Phys. Commun.; 4: No. 3, 294-298(Dec 1972).

Streamer chamber pictures were measured with a flying spot device, which uses a CRT and is controlled by a PDP-7. It is possible to recognize each individual streamer along the track. Ionization measurements can be done automatically. These results are compared with hand measurements. (auth)

27716 METHOD FOR THE AUTOMATIC ANALYSIS OF GAMMA RAY EVENTS IN ASTRONOMICAL SPARK CHAMBERS. Bignami, G. F.; Cioni, G.; Della Ventura, A.; Mussio, P.; Turner, M. J. L.; Volonte, U. (CNR, Milan). Comput. Phys. Commun.; 4: No. 3, 299-314(Dec 1972).

The increasing use of spark chambers for detecting cosmic gamma rays (SAS-B, COS-B, S-133, Mi-Sa Gamma) justifies a comprehensive study of data analysis procedures. The general problem of automatic scanning and analysis of the event records of gamma rays interaction in astronomical spark chambers is treated in two parts: the selection and cleaning of good events from a background of noise due to spurious sparks, inefficient gaps, etc. and the extraction of the best values of the direction and energy of the gamma ray from the information contained in the event record. The first is achieved by means of a syntactic analyzer which examines the correlations between the sparks forming tracks, tracks forming vertices, and vertices forming the whole events. The second applies the theory of probability to the problem of determining the parameters of the incoming gamma from the selected events. This enables these parameters to be determined in a rigorous manner from the information available taking into account the interdependence of the data. The calculation of the relevant probability distributions both by analytical and numerical methods is described. (auth)

27717 NEW TYPE OF PARTICLE TRAP. de Closets, F. Sci. Avenir; No. 311, 54-59(Jan 1973). (In French)

A detailed description of the principle of wire spark chambers and the performances envisaged from them is given. Comparisons are made with bubble chambers and classical spark chambers. (FR)

27718 UTAH NEUTRINO DETECTOR CHERENKOV SYSTEM. Cassiday, G. L.; Groom, D. E.; Larson, M. O. (Univ. of Utah, Salt Lake City). Nucl. Instrum. Methods; 107: No. 3, 509-514 (1973).

Large area directional Cherenkov detectors have been economically constructed at the University of Utah to provide a highly efficient trigger for a hodoscope of sonic ranging cylindrical spark counters. The detectors are water-filled concrete tanks having inside dimensions of 3 ft × 33 ft × 20 ft high, whose two large walls support an array of light collecting elements. A new type of highly efficient light collector which provides a wall coverage of about 70% has been developed and is now in use. Ultraviolet Cherenkov light generated by a relativistic muon passing through a tank is picked up and waveshifted to the visible by the light collectors. The visible light is then viewed by a photomultiplier tube located at one end of each collector. The output from the array on a wall corresponds to ≈13 photoelectrons with an average triggering efficiency of about 92%. The angular dependence of the triggering efficiency as well as the technology of operating phototubes underwater is discussed. Four Cherenkov tanks operated in coincidence incorrectly determine the directionality of a passing muon about once in 10^{10} transversals. (auth)

27719 TIME PROPERTIES OF MWPC USING ELECTRONEGATIVE GASES, AND THEIR EFFICIENCY OF DETECTION FOR NORMAL AND ABNORMAL PARTICLES (QUARKS). Breidenbach, M.; Sauli, F.; Tirler, R. (CERN, Geneva). Nucl. Instrum. Methods; 108: No. 1, 23-28(1973).

The efficiency for detection of fractionally charged particles of multiwire proportional chambers using electronegative gases has been investigated, using a model to simulate the ion production and drift in a MWPC and comparing the results with experimental data. (auth)

27720 NEW INSTRUMENTS FOR THE HIGH ENERGY PHYSICIST. Charpak, G. (CERN, Geneva). pp 593-601 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Some recent developments in visual detectors, multiwire proportional counters, and high spatial accuracy detectors are reviewed. (LBS)

27721 REMARK BY M. CONVERSI. (Univ., Rome). pp 602-605 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1972). See CONF-710421-.

Remarks are given on the prospects of flash-tube hodoscope chambers for particle physics, which are suggested by the preliminary results of work being carried out at Frascati on flash tubes. (LBS)

Radiometric Instruments

27722 (BRH-DEP-73-3, pp 181-191) RADIATION SAFETY FOR GAGE INSTALLATIONS. Cook, H. L. Jr. (Ohmart Corp., Cincinnati). Oct 1972.

In radiation safety and protection in industrial applications.

Radiation safety aspects of industrial radioisotope gages are discussed. Control of the two safety problems (ingestion of the radioactive material and over-exposure to the radiation) is considered. (WHK)

27723 (EURISOTOP-55(Vol.1)) RADIATION AND ISOTOPE TECHNIQUES IN CIVIL ENGINEERING. Volume I. Proceedings of a Conference of the EURISOTOP Office, Brussels, October 28–30, 1970. Proepstl, A. (ed.). (European Communities, Brussels (Belgium). Commission). 1972. 599p. (In several languages). (CONF-701027-(Vol.1)).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Eighteen papers were presented and are included in Vol. 1. A separate abstract was prepared for each of fifteen papers. The remaining papers have been previously abstracted for NSA. For abstracts of these see CONF-701027 in the Report Number Index and abstract number 26: 45718. (TFD)

For abstracts of individual papers see: 27724–27730, 27603–27605, and 27795–27799.

27724 (EURISOTOP-55(Vol.1), pp 85-104) RADIOMETRIC PROCESSES FOR MEASURINC COMPACTION AND MOISTURE CONTENT IN RAILWAY CONSTRUCTION. Cabos, H. P. (Deutsche Bundesbahn, Minden, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Because of their nondestructive nature radiometric measuring processes using gamma absorption and scattering and neutron slowing-down are particularly suitable for the measurement of variations in compaction and moisture content, possible symmetric errors in the measurement method being negligible, especially in the case of moisture. After illustrating the processes and arrangements which have been used up to now by the Deutsche Bundesbahn for the radiometric measurement of compaction and moisture content in the foundations (subsoil and anti-freeze layers) and permanent way of sections of track, the applications and experience so far arrived at are discussed with the aid of examples of work already carried out. (TFD)

27725 (EURISOTOP-55(Vol.1), pp 105-131) DENSITY CONTROL BY RADIATION IN SOIL ENGINEERING. Behr, H. Bundesanstalt fuer Strassenwesen, Cologne). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Three types of devices are described, depending on their design and the location of the volumes to be measured, i.e., surface probes, penetration probes, and depth probes. Surface probes have proved of relatively little use in soil engineering. The effective measuring depth is less than 10 cm, so that either the measurement is limited to the surface layer or the compacted soil has to be dug up layer by layer. Penetration probes show considerably better characteristics. They can make measurements to a depth of 30 to 60 cm below the surface. They thus go a long way to meet the requirements of soil engineering. Comparative measurements with conventional techniques have indicated a mean scatter of ±0.05 g/cm^3, which is exactly equal to the scatter between the conventional methods. The radiation detected by the probe consists to more than 95% of scattered radiation, so that the measured volume is about 10 times as great as the directly irradiated sector. If the density is variable only in a vertical direction, then all the horizontal layers within the measured volume exert an approximately equal influence on the observed value. Depth probes for density control of embankments show systematic errors due to the crushing of probe tubes as a result of compaction of the earth. A correction is required which will depend upon the type of probe, the diameter of the tube, the type of soil, and its density. This is illustrated by examples in the case of sand and gravel beds. The properties of radiation techniques are compared with those of conventional methods and their validity, measurement accuracy, and limits of applications are indicated. (auth)

27726 (EURISOTOP-55(Vol.1), pp 133-142) PRESENT STATE OF DENSITY AND HUMIDITY MEASUREMENT WITH ISOTOPES IN ROAD BUILDING. Huber, H. 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Two important problems in road building are the determination of the optimum density and humidity of rolled layers, and the control of the quality of base courses. For both problems there exists conventional methods, which, while giving good results, are time-consuming. For this reason attempts have been made to develop simple measuring techniques. One possible method is the use of isotopes, with which, by means of gamma back-scattering transmission radiation (density) neutron moderation (humidity), it is possible to obtain the desired result for layers near the surface in a much shorter time without taking samples. The first units produced provided proof that the method is entirely practicable. On the other hand, the equipment was heavy, cumbersome and only usable by trained personnel; in particular, evaluation of the results required special technical knowledge. Instruments are now available which have the advantages of the isotope method and at the same time can easily be handled by virtually untrained personnel. The use of integrated circuits makes it possible to reduce dimensions and weights to a minimum not previously attained. Devices are on the market which weigh less than 20 kg and contain in one casing the source, detectors and electronics for measuring the density and humidity of courses near the surface. Evaluation has been substantially simplified. In addition, the reproducibility in the field has been greatly increased by the use of relative methods and test standards. With these devices accuracies of ±0.02 g/m^3 can be obtained. (auth)

27727 (EURISOTOP-55(Vol.1), pp 163-174) TRACER TECHNIQUE USING BORON AND MOISTURE GAUGE. Aritizumi, A.; Yamamoto, T. 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Radioisotopes, used as tracers and in nuclear gages, have been applied widely for preliminary investigations and work control in the field of civil engineering. Utilization of the isotopes, however, is kept within narrow limits because of the radiation hazard to the public, especially in densely populated areas. Activable tracers, exhibiting no radiation hazard during application, constitute no danger, but they cannot be used for nondestructive inspection, which is the advantage of radioisotope techniques. A new tracing

method in which a stable nuclide is used and the advantage of radioisotope techniques maintained is described. The method is based on the principle that boron possesses a large absorption cross-section for thermal neutrons and the concentration of the boron tracer is detectable by means of a neutron moisture gauge. The new technique can be used for checking the quantity grouted in soils and the flow pattern of tremie-placed fresh concrete or for controlling the settlement of soil layers during deep soil stabilization by vertical sand drain. The results obtained are discussed. This method offers considerable potential for application in various industrial fields. The only drawback is that the concentration of boron must be relatively high during the application. (auth)

27728 (EURISOTOP-55(Vol.1), pp 175-194) DENSITY AND MOISTURE MEASUREMENT WITH FAST NEUTRONS AND GAMMA RAYS: APPLICATION TO COMPACTION CONTROL. Wack, B.; Rocoplan, J. A.; Loverdo, A.; Settipani, A. 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The rapid nondestructive determination of dry volumetric mass and moisture content by weight is of great importance in checking soil compaction (construction of earth dams, roads, canals, aerodromes, earthworks) and in the preparation of construction materials such as concrete aggregates. A method for measuring density and humidity which is based on the transmission of penetrating gamma rays and fast neutrons is described. The equipment has a double sealed source of ^{137}Cs and $^{241}Am/Be$ normally housed in a projector (enabling the measuring head to be protected from irradiation) and specially designed detectors, selectively sensitive to gamma rays and high-energy neutrons. The equipment has the advantage of being relatively insensitive to the chemical nature of the soil, of giving coherent results (volumetric mass and moisture content are determined on the same volume of material) which can be reproduced (relatively large volume of measurement, independent of moisture). The results obtained using this equipment during the building of a large earth dam are given. A simple prior calibration method using reference materials, which frees the user from the need for calibration on site, is described. (auth)

27729 (EURISOTOP-55(Vol.1), pp 195-213) IN-SITU EXPLORATIONS OF SOIL DENSITIES AND MOISTURE CONTENTS USING RADIOISOTOPES. Endo, M.; Kawasaki, T.; Ikuta, Y. 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Measurements of soil moisture and density using radioisotopes, up-to-date as a highly precise and efficient method, involve a number of problems such as complexity of calibration tests peculiar to the instruments while methods of application are not as yet established. A method of continuous exploration of ground in the direction of depth eliminating the problem of air gaps between soil and instrument due to shape of measuring apparatus is examined. Results confirm the practicality with good agreement between in-situ and laboratory tests although some modification of calibration tests is required. (auth)

27730 (EURISOTOP-55(Vol.1), pp 285-331) ISOTOPE TECHNIQUES FOR THE CONTINUOUS AND AUTOMATIC DETERMINATION OF DENSITY AND TRANSPORT CONCENTRATION IN HYDRAULIC TRANSPORT. Pahlke, H. (Versuchsanstalt fuer Wasserbau und Schiffbau, Berlin). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Equipment and procedures for automatic and continuous determination of density and transport concentration in water-sand hydraulic transport systems are described. (TFD)

27731 (EURISOTOP-55(Vol.2)) RADIATION AND ISOTOPE TECHNIQUES IN CIVIL ENGINEERING. Volume II. Proceedings of a Conference of the EURISOTOP Office, Brussels, October 28–30, 1970. Proepstl, A. (ed.) (European Communities, Brussels (Belgium). Commission). 1972. 651p. (In several languages). (CONF-701027-(Vol.2)).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A separate abstract was prepared for each of the 29 papers presented at the conference and included in Vol. 2. (TFD)

For abstracts of individual papers see: 27519–27523, 27562, 27563, 27732–27740, 27779–27783, 27790, 27800–27803, 28110, 28274, and 28344.

27732 (EURISOTOP-55(Vol.2), pp 597-606) PARTICULAR APPLICATIONS OF GAMMA DENSIMETRY. Lachaud, R. (CEBIP, Paris). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Three particular applications of gamma densimetry are described: The first is high definition measurement, and its application to the calcine of calcareous rocks. The second is the continuous measurement of clinker with a view to monitoring the performance of a cementing furnace. The third is the accurate tracing of density profiles on large hydraulic gabions and their time history. (auth)

27733 (EURISOTOP-55(Vol.2), pp 607-620) NEUTRON HYGROMETRY IN THE MANUFACTURE OF CONCRETE. Koch, E. (Laboratorium, Wildbad, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A short description of the technique is followed by some observations on the measurement parameters, showing the advantages of the technique and the requirements imposed on the device during practical use in a plant. Experience acquired in the measurement of humidity in concrete mixers by means of surface probes is reported on. In a further example the measurement of humidity in additives, particularly fine sand, by means of bunker probes is described. Details are given of the advantages of neutron hygrometry for the expansion of the pure measurement plant into a plant for fully automated concrete manufacture. The possibilities of making the water and the sand-water corrections are discussed. A fully automated concrete manufacturing plant is described and practical experience reported. (auth)

27734 (EURISOTOP-55(Vol.2), pp 621-646) SOME PRACTICAL APPLICATIONS OF RADIONUCLIDES IN THE CONSTRUCTION INDUSTRY. Dreiheller, H. (Frieseke and Hoepfner, Erlangen, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Radiometric density and moisture gages for use in the construction industry are discussed. Their uses include process control in the production of building materials, hydraulic engineering, and soil mechanics. (TFD)

27735 (EURISOTOP-55(Vol.2), pp 647-662) QUALITY CONTROL OF CONCRETE USING A NEUTRON MOISTURE GAUGE. Yamamoto, M. (Taisei Construction Ltd., Tokyo). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A neutron moisture gage for measuring and controlling the surface moisture content of concrete aggregates is described. (TFD)

27736 (EURISOTOP-55(Vol.2), pp 663-678) EXPERIENCE WITH SAND HUMIDITY MEASUREMENT USING NEUTRON PROBES. Caimann, V. (Deutsche Tafelglas AG, Weiden, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

When preparing a charge in the production of glass, care must be taken to obtain the exact amount of the component materials. With dry materials this is easy, but glass-smelting sand is as a rule supplied and used wet. Since it constitutes 60 to 70% of the charge, the water content must be allowed for in the weighing-in. It is, therefore necessary to have a quick and accurate method of determining this content. As compared with various conventional methods, nuclear techniques have the advantage of making it possible to perform the measurements without contact and through protective walls. A device is described which uses an ^{241}Am-Be probe; the number of thermal neutrons created is determined by a scintillometer and indicated digitally by a pulse counter. The count is interrupted automatically after 1 min and the sand humidity indicated numerically by a computer unit. The device has been working uninterruptedly for some years without trouble. Uniform operation is easy to monitor and control. The standard deviation of the pulse count is 1.3% with a sand humidity of 4.5%, corresponding to about 6000 useful pulses. The confidence limits for the simple statistical reliability of the sand humidity determination are therefore ±0.1% absolute. (auth)

27737 (EURISOTOP-55(Vol.2), pp 727-741) RADIOMETRIC MEASUREMENTS ON MAGNESITE ROCKS. Frevert, E.; Roetzer, H. (Oesterreichische Studiengesellschaft fuer Atomenergie mbH, Vienna). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

In order to perform nondestructive tests on magnesite bricks to determine the degree of tar impregnation, the bricks are irradiated with thermal neutrons. Due to the relatively large scatter cross-section of hydrogen, the attenuation of the neutron beam when it passes through the brick is proportional to the hydrogen atom content and hence also to the tar content or degree of impregnation. A constant density in magnesite bricks is necessary for uniform burnup. A radiometric method for rapid nondestructive measurement of the density distribution in magnesite bricks is described. In preliminary tests on various types of brick it was found that for

most of them the method of irradiation with ^{241}Am gave the best results. The actual measuring station consisted of a 100 mCi ^{241}Am source, a scintillation detector, and the associated electronics. The accuracy of density measurement was better than ±0.01 g/cm^3. This rig was also used for measuring density profiles on feather bricks; the results of these show good agreement with theoretical considerations based on the molding cycle. (auth)

27738 (EURISOTOP-55(Vol.2), pp 863-880) USE OF LOW CURRENT IONIZATION CHAMBERS FOR FIRE DETECTION PURPOSES. Carbonnel, H. (GAAA, Le Plessis Robinson, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

There are many types of fire-detection devices, but low-current ionization chambers are in wide use and are the most efficient. New sources using americium, obtained by irradiating polonium make detectors of this type safer and more reliable. Various applications, with point or line detectors, are possible. (auth)

27739 (EURISOTOP-55(Vol.2), pp 919-937) RADIOMETRIC DUST EMISSION MEASUREMENTS IN THE CEMENT AND STEEL INDUSTRY, AND ALSO IN COAL AND LIGNITE POWER PLANTS. Dresia, H. (Staatliche Ingenieurschule, Essen); Spohr, F. 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A beta radiometric gage for measuring dust emission from various industrial plants is described. (TFD)

27740 (EURISOTOP-55(Vol.2), pp 967-980) RADIOMETRIC DENSITY MEASURING EQUIPMENT FOR THE DETERMINATION OF SOLID MATTER CONTENT. Bierwolf, H. (Hartmann and Braun, Heiligenhaus, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Radiometric density gages for determining solid matter content of fluids are reviewed. Application of the gages in drainage engineering, dredging, wet-sand cement production processes, and the manufacture of Eternite tiles is discussed. (TFD)

27741 EVALUATION OF ERRORS AND OPTIMUM PARAMETERS OF GAMMA-RAY MOISTURE METERS. Dubinchuk, V. T. Meas. Tech. (USSR) (Engl. Transl.); 15: No. 10, 1539-1542(Oct 1972).

Translated from Izmer. Tekh.; 15: No. 10, 62-64(Oct 1972).

Formulas are derived for evaluating the measurement error and its relation to structural parameters and measuring conditions are analyzed. The design and block schematics for measurements are examined and formulas are suggested for selecting optimum parameters for gamma-ray moisture measurements. (WHK)

27742 COMPENSATION OF THE EFFECT OF A NEIGHBORING ZONE ON THE RESPONSE OF GAMMA SURFACE DENSIMETERS. Pavlov, L. S. Geofiz. App.; No. 49, 48-51(1972). (In Russian).

The possibilities of compensating for the effect of an adjacent zone on surface gamma densimeters are considered using a division of the count rate of the fundamental and compensating detectors. By the judicious choice of placement and parameters of the collimator of the compensating detector it was possible to decrease the effect of the adjacent zone on the densimeter readout by a factor of several times and still preserve the general sensitivity. Use of the compensating detector made it possible to examine an uneven surface and to explore different types of structure disarrangements. (tr-auth)

27743 THICKNESS GAGE FOR THE WIDE FLANGE. Miyagawa, K.; Egashira, T. (Nippon Steel Corp., Tokyo). Proc. Jap. Conf. Radioisotop.; No. 10, 343-344(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Conventional thickness measurement of H-shaped steel with hand micrometers has been converted to the measurement with radiation thickness gages developed to measure three-way thicknesses of a web and both flanges of the H-shaped steel using one source. The gages measure the thickness of H-shaped steel at 900 to 1100°C, up to 120 mm with a variation of ±2.0% or less, with 5 Ci of ^{137}Cs. Since the size of the H-shaped steel varies over a wide range, the source assembly cannot be fixed. Therefore, the gages use O-shaped double frame holders. The source assembly and detectors are mounted on the inner frame which is hung on the outer frame. Radiation beams can irradiate the center of each surface to be measured by moving the inner frame up and down according to the size of the steel. Thus far, security of safety against radiation and sufficient protection of the gages against the vibration of rolling mills, cooling water, scale, and the like are problems. (JA)

27744 ON-LINE USE OF THICKNESS GAUGE IN IRON AND STEEL INDUSTRY. Fujii, S. (Nippon Kokan, K. K., Fukuyama, Japan). Proc. Jap. Conf. Radioisotop.; No. 10, 340-342(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Although x-ray thickness gages have been used mainly for on-line measurement in the hot rolling of steel sheets, recently thickness gages using radioisotopes (γ thickness gages) came to be reexamined again. The reason is twofold. One is that x-ray generators are expensive and are not easy to handle in comparison with the γ thickness gages. Another is the appearance of high-performance semiconductor amplifiers and the use of an Am source. The superiority of the γ thickness gages has been assured in the Fukuyama Iron Works, Nippon Kokan, Ltd. The gages use 10 Ci of ^{137}Cs and measure steel sheets of 0.45 to 90 mm thickness at 700 to 1100°C. The correction of the effect of temperature and alloy element contents, and the averaging of slight thickness variations along sheet length have been made possible by utilizing a computer, and resulted in their accurate performance. As a result, the conventional direct thickness measurement with hand gages has been completely abandoned, and now operation depends only on remote control, decreasing dispersion in the quality of products. (JA)

27745 APPLICATION AND ADVANTAGE OF BETA GAUGE IN THE PULP AND PAPER INDUSTRY. Aoki, H. (Daishowa Paper Mfg. Co. Ltd., Fuji, Japan). Proc. Jap. Conf. Radioisotop.; No. 10, 337-339(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

In the pulp and paper industry, gages for the measurement of basic weight are used in the final process of paper making. In the system described, the moisture weight as well as the basic weight is measured, while in other products, only the thickness is obtained. For the basic weight, the degree of beta-ray penetration is utilized, while in the moisture weight, the change in either the dielectric constant or the infrared absorption is employed. The measurement is carried out in the width and longitudinal directions of paper sheets. By making use of the system for measurement, advantages are acquired in quality improvement, economy in fiber, increase in production, savings in steam, etc. It is possible to recover invested capital within a year of operation. As the actual examples of its economic effect, cases of a firm in Japan and one in the United States are given. Finally, the significance of system engineering and the trend to the computer control of paper machines are pointed out. (JA)

27746 THEORY AND EXPERIMENT OF NUCLEAR WIRE THICKNESS GAUGING. Plesch, R. Messtechnik; 80: No. 10, 284-290(Oct 1972). (In German).

The method of nuclear wire thickness gaging is briefly described and its sensitivity and accuracy defined. Subsequently the general theory to find out these two criteria of a measuring method is pointed out. A numerical comparison with measurements on steel and structural steel wires gave satisfactory agreement between theory and practice. The measuring equipment improves the diameter deviation of the final product an outstanding amount. (auth)

27747 RADIOISOTOPIC INSTRUMENT FOR AUTOMATICALLY MEASURING THE WEIGHT OF A SINTERING CHARGE. Mukanov, D. M.; Stroykovskii, A. K.; Pershin, A. A. pp 306-311 of Radioizotop. Sredstva Kontrolya i Avtomatiz. Tekhnol. Protsessov v Prom-sti. Moscow; Atomizdat (1972). (In Russian).

A weight meter for continuous determination of the weight of a material during free fall at transfer points with simultaneous weighing of the components of a sintering charge at 36 points is described. The measurement method is based on the Compton process of interaction between gamma rays and matter. (UPRS)

27748 RADIOACTIVE LEVEL GAUGE USING A LOGARITHMIC IONIZATION CHAMBER DETECTOR. Fries, B. A. (Chevron Research Co., Richmond, CA). Proc. Jap. Conf. Radioisotop.; No. 10, 225-229(Apr 1972).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

The necessity of continuous gaging occurred in controlling the level of evaporator vessels in a petroleum thermal cracking plant. For these vessels, a level gage was developed, which uses an ionization chamber having natural exponential response. The chamber is pressurized to 10 atmospheres with argon to improve its response. The basic circuit uses a pentode electrometer tube connected as a triode, thus stability problems with high megohm resistors are eliminated, and it results in logarithmic output. An encapsulated ^{60}Co source is placed at the end of a long handling rod. Source intensity of about 200 mCi is selected to give radia-

tion intensity of 5 to 10 mr/hr at a detector. A calibration curve was obtained by making a series of measurements at known levels. However, it was found that calibration is possible by calculating expected readings, with sufficient accuracy. The accuracy over the most useful part of the range is ±2 to 4 cm at the total 1.69 m level. (JA)

27749 METHOD AND MEASURING EQUIPMENT FOR CONTINUOUS NON-CONTACT NON-DESTRUCTIVE MONITORING OF THE DIAMETER OF EXTRUDED MATERIAL. Knorr, J. (Technische Univ., Dresden). Isotopenpraxis; 8: No. 8, 310-314(Aug 1972). (In German).

A new method and measuring equipment for continuous non-contact non-destructive diameter monitoring is described. They provide monitoring of extruded material, such as cables, wires, and tubing. The radiation sources and the detector are arranged in a way as to make the determined values a measure of the samples plan area which is perpendicular to the direction of movement. This renders possible monitoring of processes such as cable sheathing with conductors having not only circular but also elliptical or circular-sector cross section. Changes of the distance between the material to be monitored and the measuring unit do not affect the measured value. The described unit can detect alterations of diameter of material having circular cross section down to 0.02 mm with diameters ranging from 3 up to 20 mm. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

27750 (AD-749477) REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). Interim Technical Report, 17 May 1971–17 May 1972. Horne, W. E.; Madaras, B. K. (Boeing Co., Seattle, Wash.). Aug 1972. Contract F33615-71-C-1583. 88p. (AFCRL-TR-72-69). NTIS.

A technique is being developed for the accelerated evaluation of silicon solar cells to be used in extended space missions during which weapons environments may also be encountered. Standard N/P silicon cells, as well as lithium doped silicon cells, are being used as test samples during the development and verification of the evaluation method. An analysis of existing literature and the philosophy of approach to the problem resulting from the analysis are presented. An exploratory test program designed to augment existing data and to further develop the method of approach is described. Also, a real-time test currently underway which involves N/P and lithium doped solar cells exposed simultaneously to low-flux electron and proton radiation plus illumination is described. (auth)

27751 EFFECTS OF NUCLEAR RADIATION ON CERAMIC CEMENTED STRAIN GAGES AND POLYIMIDE-ENCAPSULATED EPOXY BONDED GAGES. Tallman, C. R. (Los Alamos Scientific Lab., NM). Advan. Instrum.; 26: 622.1-622.5(1971).

From 26th Annual ISA Conference and Test Measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt. 2).

A set of strain gages were irradiated in the Omega West Reactor at Los Alamos to evaluate their stability for use in transducers for measurement of pressure, force, displacement and acceleration in regions of high neutron and gamma flux on the Rover and NERVA nuclear rocket vehicles. This experiment is described and the results are compared with previously reported strain gage radiation effects data. (auth)

27752 INFLUENCE OF THE BIASING CONDITIONS AND OF THE POWER DISSIPATED IN TRANSISTORS DURING IRRADIATION ON THE PERMANENT RADIATION DAMAGE. Raicu, B. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 17: No. 7, 795-799(1972).

The experimental investigation of the permanent modifications of the parameters h_{21e}, I_{EB0}, and I_{CB0} of germanium alloy and drift transistors, as a function of the bias conditions during exposure, is described. Irradiation with 3 MeV electrons was obtained with the linear electron accelerator of the Institute of Atomic Physics in Bucharest. The influence of the carrier injection and of the dissipated power during the irradiation was studied. The conclusions concern the optimum working conditions for the devices for operating in a radiation environment. (auth)

27753 RADIATION DAMAGES IN SILICON SURFACE BARRIER DETECTORS WITH 0.5 TO 1.5 MeV ELECTRONS. Nakamoto, S. Mem. Chubu Inst. Technol.; 8: 143-152(Dec 1972).

The radiation damages in surface barrier detectors with 0.5 to 1.5 MeV electrons were investigated. The detectors were fabricated from phosphorus-doped silicon crystals with a resistivity between 200 and 5000 Ω cm. The changes in the forward and reverse currents, the junction capacitance, the ^{241}Am alpha spectrum, and their annealing behaviors were measured. The junction capacitance decreases monotonically with fluence and at high fluence is independent of reverse bias. The spectra of ^{241}Am alpha are degraded by the increase of the fluence. The shift of the peak channel to the lower energy side is observed. The detector with the low resistivity substrate is more stable against the irradiation. At high fluence, the particles incident on the rear ohmic contact are detected at low reverse bias. The degradation of the detectors begins to occur when they are subjected to the irradiation of 0.5–1.5 MeV electrons in the range of 1×10^{14} to 1×10^{15}/cm^2. The damage center has an acceptor-type property and acts as a trapping center for the carriers created by incident particles. The formation rate of this acceptor-type center is in the range of 0.3×10^{-3} to 1.5×10^{-3}/cm. Annealing behavior of this center is not observed clearly up to 220°C and the center should be considered as the divacancy. By removing the irradiated surface region of the detectors, the detectors were fabricated again and the damage distribution in depth was observed. (auth)

27754 ANNEALING OF SURFACE BARRIER DETECTORS IRRADIATED WITH 0.5 MeV ELECTRONS. Aoki, T. Mem. Chubu Inst. Technol.; 8: 159-165(Dec 1972). (In Japanese).

Surface barrier detectors, fabricated from floating-zone-refined, P-doped, n-type silicon single crystals with resistivities of 150, 500, and 1,000 Ω cm, were irradiated with 0.5-MeV electrons, and then annealed with the view of recovering from radiation damage. From practical point of view, the annealing at relatively low temperature (100~200°C) and in room air atmosphere was done. Resulting changes of the depletion-layer-capacitance, reverse current, and response for α particles were measured. As to the pulse height for α particles and the depletion-layer-capacitance, the annealing gives remarkable recovery at 120 to 160°C, which may be attributed to P-vacancy dissociation, and a little recovery above that temperature. While the reverse current tends to increase by annealing at 160 to 200°C. This may be attributed to surface leakage current. Therefore the most desirable temperature is about 150°C for the annealing described above. However, the effects of annealing depend on the energy and dosage of electrons, and the properties of the initial silicon crystals. (auth)

Miscellaneous Instruments

Refer also to abstracts 27517, 27518, 27534, 27546–27550, 28128, 28133, 28134, 28138, 28228, 28957, 28958, 29052, 29158, and 29172.

27755 (CONF-720908-, pp 444-449) MAGNET TECHNOLOGY AT THE MULLARD CRYOMAGNETIC LABORATORY OF THE CLARENDON LABORATORY, OXFORD. Hudson, P. A. (Oxford Univ.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The original high field installation of the Clarendon Laboratory is based on a 2000 kW dc generator. This machine now serves 7 water-cooled solenoids, most of them mobile both vertically and horizontally, giving maximum fields ranging between 4.5 T (102 mm internal diameter) and 12 T (25 mm internal diameter). The installation has been used for a variety of experiments comprising nuclear orientation and nuclear cooling, magneto-optical spectroscopy, research on the properties of semiconductors and semi-metals, measurements on high field superconductors and biochemical applications; and a wealth of technology particularly of the design and construction of resistive solenoids has been accumulated. With the advent of high-field, high current density superconducting materials, magnet technology has developed in 2 directions. (1) To relieve the pressure on the single power supply, resistive solenoids are being replaced wherever possible by superconductive coils. These range from simple coils built into the experimental helium cryostat to a coil with a room temperature bore of 51 mm which is to all intents and purposes identical with the standard 51 mm i.d. 9 T resistive solenoids. (2) In order to increase the available fields to about 16 T a hybrid magnet is being constructed. It comprises a 9.3 T, 51 mm bore 2 MW resistive solenoid, surrounded by a 6.7 T superconducting solenoid. In addition a 25 mm bore liquid helium immersed 15 T superconducting coil is being designed. (auth)

27756 EFFECTS OF PHOTON COLLIMATORS ON THE SPECTRAL DISTRIBUTION OF BREMSSTRAHLUNG RADIATION BETWEEN 20 AND 35 MeV. Nath, R.; Firk, F. W. K.; Schultz, H. L. (Yale Univ., New Haven). Nucl. Instrum. Methods; 108: No. 1, 199-200(1973).

The relative effects of photon collimators on the spectra distribution of bremsstrahlung radiation in the energy range 20 to 35 MeV have been measured using a high resolution photon spectrometer. (auth)

27757 NEUTRON COLLIMATORS WITH PLATES OF SELF-CONTRACTING FOILS. Meister, H.; Weckermann, B. (EURATOM-CCR, Ispra, Italy). Nucl. Instrum. Methods; 108: No. 1, 107-111(1973).

Airplane model paper and thermoplastic foils have been used for the construction of neutron collimators. A methodical instruction and the results of a performance test carried out with two identical paper collimators of 10′ collimation angle are reported. (auth)

27758 STATISTICAL MODEL OF FAST MULTIFOLD COINCIDENCE CIRCUITS OF SERIAL STRUCTURE. Kalisz, J. (Laboratorio di Fisica Cosmica e Technologie Relative, Milan). Nucl. Instrum. Methods; 108: No. 1, 139-145(1973).

Fast multifold coincidence circuits which consist of two or more double coincidence circuits connected in series are studied. With respect to the triple coincidence circuit, the probability density of the registration time of the first double coincidence circuit, the coincidence surface and the coincidence curve are determined analytically. The analysis is carried out under the assumption of noncorrelated Gaussian jitter distributions at the circuit inputs. The slope method is presented for the determination of the circuit statistical parameters. A detailed comparison is given between the circuit analyzed and the classical triple coincidence circuit of parallel structure. The theory is then generalized for multifold coincidence circuits. (auth)

27759 SIMPLE NEUTRON DIFFRACTOMETER FOR LOW ANGLE BIOLOGICAL STUDIES. Nunes, A. C. (Brookhaven National Lab., Upton, NY). Nucl. Instrum. Methods; 108: No. 1, 189-191(1973).

It was found that a spectrometer using roughened cadmium plated Soller slits and a pyrolytic graphite analyzer of 1° mosaic (matching analyzer dispersion to sample dispersion) can be sufficient to perform some scattering experiments on viruses and enzyme complexes in solution. (auth)

27760 ELECTROCHEMICAL APPARATUS FOR DETERMINATION OF MOLTEN SALT COMPOSITION. Romberger, K. A.; Braunstein, J. (to United States Atomic Energy Commission). U. S. Patent 3,714,014. 30 Jan 1973. Filed date 10 Feb 1971. 6p.

An electrochemical cell and method are described that permit continuous monitoring and precise adjustment of the composition of a fuel salt solvent for molten salt nuclear reactors without using electrodes or solutions of extraneous materials as a variable to monitor composition changes. A concentration cell with transference was established which consists of identical half-cells separated by an ion transfer barrier, one having a fixed composition and the other having a composition which is unknown. The emf of the concentration cell, which is a function of the composition change in the half-cell containing the unknown composition, is measured and the molten salt composition determined from a calibration plot. (Official Gazette)

27761 ADVANCES IN INSTRUMENTATION. Volume 26, Part 2. Proceedings of the 26th Annual ISA Conference, Chicago, October 4–7, 1971. Pittsburgh; Instrument Society of America (1971). 284p. (CONF-711003(Pt.2)).

From 26th annual ISA conference and test measurements; Chicago, Illinois, USA (4 Oct 1971).

Thirty-two papers were presented at the conference. A separate abstract was prepared for each of 7 papers. The remaining 25 papers were not within the scope of NSA. (WHK)

For abstracts of individual papers see: 27530, 27751, 27762, 29458, 29479, 29498, and 29520.

27762 PRESSURE MEASUREMENTS IN SODIUM SYSTEMS. Lawford, V. N. (ITT Barton, Monterey Park, CA). Advan. Instrum.; 26: 627.1-627.7(1971).

From 26th Annual ISA Conference and Test Measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt. 2).

Differential pressure, dual-bellows type instruments are described. Design features of the dual-bellows DP unit, applications of the DP unit, instruments available, NaK-filled capillary systems, techniques of NaK filling, and a method for in-place calibration of NaK-filled instruments are discussed. (auth)

27763 POSSIBILITY OF THE APPLICATION OF THE CORUNDUM CRYSTAL AS A POLARIZER FOR HIGH ENERGY PHOTONS. Avakyan, R. O.; Armaganyan, A. A.; Darbinyan, S. M. (Inst. of Physics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 7: No. 4, 298-300(1973). (In Russian).

Values of the asymmetry parameter and polarization are obtained when unpolarized photon beam passes through the corundum crystal of a given thickness. (auth)

27764 CAMAC SYSTEM. Wagner, F. (Slask Polytechnic Inst., Gliwice, Poland). Pomiary, Automat., Kontr.; 18: No. 11, 508-510(Nov 1972). (In Polish).

CAMAC is a universal electronic system established by the International Commission ESONE for providing a communication link between nuclear engineering laboratories of Western Europe. The functional interconnection schematic, the signal characteristics, and essential logic data of a single CAMAC casette, which may contain up to 23 modules including the control module, are shown. A multicasette (maximum 7) hook-up to a central unit, i.e., to a computer is also shown. Information is transmitted between a CAMAC casette module and the computer through the control module and the system control on the casette side and an interface system on the computer side. The performance of the CAMAC system as an information gathering and distributing system, its impact on modules and components development, and possible future applications are discussed in the light of its relatively short existence since 1969. (JPRS)

27765 NUCLEAR GYROSCOPES IN SPACE NAVIGATION. Jatczak, J. Postepy Astron.; 6: No. 1, 47-54(1972). (In Polish).

The atomic nucleus is examined as a quantum mechanical system possessing a certain mechanical moment of momentum and a magnetic moment whose direction is correlated with the moment of momentum vector. The utilization of the physical properties of this system for purposes of space navigation is discussed, and static and dynamic methods of applying nuclear gyroscopes are outlined. The dynamic method is based on nuclear resonance effects, while the static method involves nucleus polarization. (IAA)

27766 ELECTRON DEVICES IN BASIC RESEARCH. Dastidar, P. R. (Bhabha Atomic Research Centre, Bombay). pp 1-16 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

27767 HIGH-PRECISION GENERATING VOLTMETER. Mitra, B. (Bose Inst., Calcutta); Joyce, N. G.; Allen, W. D. pp 495-500 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

27768 RECENT PRECISION MASS MEASUREMENTS AT PRINCETON. Smith, L. G. (Princeton Univ., NJ). pp 164-171 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). (See CONF-710931–.

It has been found that the primary known sources that limit precision of mass measurements with an RF spectrometer are small electric fields that do not shift with the applied voltages in inverse proportion to the masses being compared. Methods of neutralizing the effect of these fields are discussed. Results of measurements of four doublets at mass numbers 3 and 4, whence have been obtained the mass excesses of ^{4}He, ^{3}He and T, are given. (UK)

27769 IMAGE ABERRATIONS OF DOUBLE FOCUSING MASS SPECTROMETERS. Matsuda, H.; Matsuo, T. (Osaka Univ.). pp 192-200 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

Calculations are presented which show that the influence of the fringing fields on the image aberrations is relatively large. In order to design a mass spectrometer with second-order double focussing, it is important to consider the fringing fields. It is also shown that even in first-order focussing a small correction is necessary. (UK)

27770 FAST ON-LINE ANALYSIS OF FISSION PRODUCTS AND THE PRODUCTS OF HEAVY ION REACTIONS. Ewald, H. (Univ., Giessen, Ger.). pp 201-209 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Work already reported using a fission particle mass spectrograph at the research reactor Garching is outlined. The realization that for studies of the nuclear structure of the fission particles by coincidence measurements of their short-lived β and γ radiations much higher intensities were required arose from that work. Accordingly, a more powerful fission particle parabola spectrograph is under construction at the high flux reactor at Grenoble. The facility and the techniques likely to be used are outlined. The more difficult, though analogous, problem of the analysis of the heavy-ion reaction products emerging from a thin target is considered. (UK)

27771 IMPROVEMENTS IN OR RELATING TO FLUID LOGIC ALIGNMENT SENSING APPARATUS. Fisher, M. J.; Scott, F. (to United Kingdom Atomic Energy Authority). British Patent 1,301,144. 29 Dec 1972. Filed date 20 Feb 1970. 8p.

The apparatus described has particular application in the measurement of strain of a specimen located in a remote inaccessible region, for example in a radioactive environment; it may be used to measure creep of specimens in a nuclear reactor core. Full details are given of the apparatus. (UK)

27772 IN SITU MASS SPECTROMETRY OF ALPHA PARTICLE TRACKS THROUGH MICA BOMBARDED WITH A BACKING ^{241}Am SOURCE. Kawama, Y.; Aratani, M. (Inst. of Physical and Chemical Research, Saitama, Japan). J. Mass Spectrom. Ion Phys.; 10: No. 4, 493-495(Feb 1973).

The mass spectrum of ions from 8 μ-thick mica bombarded with a backing americium-241 alpha source was measured in a magnetic spectrometer. It was found that this "in situ" method in mass spectrometry may be a promising tool for studies of radiation damage in general. (WHK)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstract 28332.

27773 (JUL-889-PC) DIVISIBLE ION SOURCE FOR MODERATE ROUTINE USE IN THE SIDONIE TYPE MASS SEPARATOR. Ihle, H.; Lipperts, H.; Reimer, W. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie). Sep 1972. 35p. (In German). Dep. NTIS (U. S. Sales Only).

The design of an ion source is set forth, a special feature of which is a replaceable block system that largely improves the availability of the ion source and at the same time reduces the manufacturing cost. Practical experiments with this ion source in the Sidonie-type mass separator have shown that even after a breakdown of the ion source either due to a cathode failure, a breakdown of the oven, or a depletion of the substance, long-term separations can be continued within short periods of time by simply exchanging the head of the ion source. This special block system offers the possibility of quickly rebuilding and adapting the equipment to various temperatures, various types of ion sources and structural materials. In the case of radioactive materials being used, the equipment can be easily decontaminated and valuable substances can likewise be easily recovered. The vacuum in the source has been considerably improved by means of appropriate vacuum units, which is of importance with regard to transmission and resolution. (GF)

27774 (MLM-2005) $^{3}He-^{4}He$ DISTILLATION APPARATUS. Wilkes, W. R. (Mound Lab., Miamisburg, Ohio). 21 Mar 1973. Contract AT(33-1)-Gen-53. 15p. Dep. NTIS $3.00.

A distillation cryostat for the continuous separation of $^{3}He-^{4}He$ mixtures was constructed and operated. The cryostat incorporates a recirculating ^{3}He refrigerator, precooled by an unpumped ^{4}He bath in order to cool the condenser to the operating temperature, 1.5°K. The large volatility ratio between ^{3}He and ^{4}He permits the separation of mixtures into 99.99% pure ^{3}He and 99.99% pure ^{4}He in a column only 30 cm long. Helium-3 product has been obtained at a rate of 3 liters/hr (STP) from mixtures initially containing only 7 to 10% ^{3}He. (auth)

27775 SULZER RECTIFYING PLANTS FOR ENRICHING HEAVY WATER. Zmasek, R. (Winterthur Engineering Works Div., Switzerland). Sulzer Tech. Rev.; 54: No. 3, 199-207(1972).

For some 20 years Sulzer has been designing rectifying plants for separating H_2O and D_2O. Typical plants recently installed for the final enrichment stage in heavy water production facilities and for reconcentration of diluted heavy water in nuclear power stations are described. (auth)

Isotopic Power Sources

Refer also to abstracts 27496, 27497, 27499, and 27507.

27776 RADIONUCLIDE BATTERIES EMPLOYING ^{238}Pu AND ^{90}Sr AS FUEL. Poole, M. J. (Atomic Energy Research Establishment, Harwell, Eng.). Proc. Jap. Conf. Radioisotop.; No. 10, 85-98(Apr 1972).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Power generators utilizing radioisotope heat sources and semiconductors of the bismuth telluride family as converters are described. The isotopes used for the power sources are ^{238}Pu and ^{90}Sr. The former is an α emitter, and is utilized in miniature nuclear batteries designed to power heart pacemakers without any thick shielding, while the latter is economical, and has been used in a number of practical generators having output power between ½ and 30 watts. An equation derived by Penn gives the maximum possible conversion efficiency from heat to electricity, in which the thermoelectric factor of merit Z is given by $Z = \alpha^2 \cdot \sigma/K$, in which α is the mean Seebeck coefficient for the materials to be used, σ is the mean electric conductivity, and K is the mean thermal conductivity. Work at Harwell has concentrated mainly on the use of bismuth telluride and bismuth telluride alloys having Z values of around 3×10^{-3} for p-type and 2×10^{-2} for n-type. Using the material available, thermoelectric modules were produced, and gave a conversion efficiency of over 7% when operated between 270° and 50°C. Characteristic current–voltage curves of the RIPPLE generator show that the equivalent circuit of an isotope power generator is a constant voltage dc supply. Output varies with ambient temperature. The variation of output with time was investigated. Since the first RIPPLE generator was manufactured in 1965, nine generators have been made, and the tenth is under construction. The power of the nine generators was 30 mW to 4 W, and that of the tenth is 30 W. The safety of the radioisotope generators and the ^{238}Pu-fueled miniature nuclear batteries is illustrated. (JA)

27777 RADIOISOTOPE CAPSULE PROTECTION STRUCTURE. Aranguren, J.; Stansel, J. C. (to TRW Inc.). U. S. Patent 3,723,742. 27 Mar 1973. Filed date 11 Apr 1968. 4p.

For safety reasons and to prolong the life of a radioisotope capsule and to increase the operating temperature, a radioisotope fuel is enclosed by an inner inert member and a high-strength second member and an inert outer member. A vent is provided for release of the helium generated by isotope decay to avoid high pressure within the capsule. (Official Gazette)

Radiation Sources

Refer also to abstracts 27513, 27687, 27722, and 28319.

27778 (BRH-DEP-73-3) RADIATION SAFETY AND PROTECTION IN INDUSTRIAL APPLICATIONS. Proceedings of a Symposium, Washington, D. C., August 16–18, 1972. Klein, H. F. (ed.). (Bureau of Radiological Health, Rockville, MD. Div. of Electronic Products.). Oct 1972. 330p. (CONF-720852-). NTIS. GPO $3.75.

Nineteen papers were presented at the conference. A separate abstract was prepared for each paper. (RCK)

For abstracts of individual papers see: 27505, 27513–27518, 27564, 27565, 27620, 27666, 27722, 27792–27794, 27888, 27991, 29362, and 29363.

27779 (EURISOTOP-55(Vol.2), pp 691-697) OBSERVATION OF THE TRANSPORT OF DISSOLVED SALTS DURING DRYING IN CERAMIC BODIES BY RADIOACTIVE CARBON. Schwiete, H. E.; Kroernert, W.; Bleckmann, H. 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The migration of Na_2CO_3 in a cast ceramic body was observed during drying. For this purpose the change in the Na_2CO_3 concentration vs the drying time in the body was studied with the help of the radioactive isotope ^{14}C. It was found that measurable concentration changes, which were highly dependent upon the drying speed, occurred only directly in the drying zone. A study of the plaster molds used showed that the Na_2CO_3 diffusion front remained appreciably behind that of the liquefaction water, which must be due to the reaction of the Na_2CO_3 with $CaSO_4$, leading to the formation of difficultly soluble $CaCO_3$. (auth)

27780 (EURISOTOP-55(Vol.2), pp 757-768) DETERMINATION OF SURFACE PROPERTIES OF WOOD-BASED PANELS. Schweers, W.; Rothkamm, M. (Bundesforschungsanstalt fuer Forst- und Holzwirtschaft, Hamburg). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

There is an increasing tendency to finish wood-based panels with coatings of foil and varnish. The techniques and costs involved in the coating process depend mainly upon the surface geometry of the panel and its roughness. In addition, the appearance of the polished surface is conditioned largely by the regularity or irregularity of the surface of the original panel. A measurement technique has been developed by means of which the deviations from the ideal surface can easily be determined. With this technique, plates of ground crystal glass are coated with a color film activated with ^{90}Y. These plates are pressed hydraulically against the panel surfaces to be tested, and the form variations, undulations, grinding grooves, etc., are deduced from the transferred activity. With the aid of index numbers compiled for specifically defined surfaces, and from the visually discernible structure picture, it is possible to form conclusions as to the coating properties of such wood-based panels. In addition, mass per unit curves are plotted for the wood-based panels by means of β-ray absorption ($^{90}Sr + ^{90}Y$), and a correlation was found between the fluctuation of the mass per unit and the surface geometry. (auth)

27781 (EURISOTOP-55(Vol.2), pp 769-808) EFFECT AND APPLICATION OF HIGH-ENERGY RADIATIONS IN WOODEN OR WOOD-PANELLED BUILDINGS. Kollmann, F. 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The effects of high-energy radiation on the chemical and strength

properties of wood are discussed. Radiometric methods for testing the density and growth characteristics of wood are given. (TFD)

27782 (EURISOTOP-55(Vol.2), pp 881-908) LIGHTNING CONDUCTOR SYSTEM USING RADIOISOTOPES. Berlo, G. 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The development and performance of a lightning rod containing ^{241}Am are described. Tests comparing the new rod with a Franklin rod on top of a skyscraper in France showed that the improved rod gave a rate of ionization about one million times higher than the Franklin rod. (TFD)

27783 (EURISOTOP-55(Vol.2), pp 909-916) SHORT COMMUNICATION ON KRYPTON-85 RADIOACTIVE LIGHTNING CONDUCTORS. Constant, R.; Depoitier, J. (CEN, Mol, Belgium). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The use of ^{85}Kr as the source of ionizing radiation in lightning rods is suggested. Alpha sources, such as ^{241}Am, are more likely to release radioactivity to the environment and are less efficient. (TFD)

27784 ^{252}Cf, A NEW NEUTRON SOURCE FOR SCIENCE AND ENGINEERING. Wiggins, P. F. (Naval Academy, Annapolis, MD); Duffey, D. Eng. J. (Montreal); 55: No. 9, 22-24(Sep 1972).

^{252}Cf is a spontaneously fissioning isotope produced in a high-flux reactor by the Savannah River Plant of the U. S. Atomic Energy Commission. It is an intense neutron source with a neutron energy of 2.3 MeV, available at a cost of $10/mg. Because the fission products are similar to those from ^{235}U, ^{252}Cf is useful in reactor studies. In a multiple-source assay, it could give the same spectrum and neutron flux as a 100 kW reactor. It is especially useful for "in situ" activation analysis, for example, well-logging of boreholes in nickel deposits, or other mineral deposits. Some typical gamma ray spectra are depicted. Present uses include forensic studies, health physics studies, and instrument calibration. The portability of a small ^{252}Cf source, screened by water or paraffin, is advantageous. (CA)

27785 RADIOISOTOPIC SOURCES ^{109}Cd, $^{147}Pm/Al$, ^{241}Am, AND ^{57}Co FOR ROENTGENOMETRIC ANALYSIS OF MINERALS. Betin, Yu. P.; Krampit, I. A.; Pel'ts, S. A. Geofiz. App.; No. 49, 55-59(1972). (In Russian).

Data were obtained on the contrast of analytical lines and the threshold of sensitivity of x-ray analysis of a number of elements with Z = 25 to 82. The sources tested for their relative usefulness in this work were: 5 μCi ^{109}Cd, 10 μCi ^{57}Co, 2.5 Ci $^{147}Pm/Al$, and 10 μCi ^{241}Am. The threshold of sensitivity was n(0.1 to 0.02)%, which was adequate for solving many practical problems in x-ray analysis. (KSW)

27786 INDUSTRIAL USES OF NEUTRON RADIATIONS AND RADIOPROTECTION. Candes, P. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.), Suppl.; No. 90, 25-28(1971). (In French).

The different types of neutron source used in industry are presented, i.e., sealed sources, particle accelerators, and small reactors. From the point of view of radioprotection, absorbed dose measurements involve technical difficulties. The energy spectra of the particles can be determined from equivalent dose measurements. Various zone dosimetry techniques are discussed (measurements of the spectra, instrumental techniques giving a response representative of the dose, and technique involving fluence measurements). Personnel dosimetry problems are discussed. (FR)

27787 NEUTRON SPECTRUM OF A $^{227}Ac-Be(\alpha,n)$ SOURCE. Geiger, K. W.; Van der Zwan, L.; Werle, H. (National Research Council of Canada, Ottawa). Int. J. Appl. Radiat. Isotop.; 24: No. 3, 165-169(Mar 1973).

The neutron spectrum of a 3.4-mCi $^{227}Ac-Be$ source was measured with a stilbene spectrometer above E_n = 2 MeV and with gas-filled proportional counters below this energy. The average neutron energy of the spectrum is $\bar{E}$ = (3.14 ± 0.10) MeV and the fluence to kerma conversion factor in wet tissue is d_k = (3.20 ± 0.07)10^{-7} erg g^{-1} cm^2. The number of neutrons below E_n = 1.5 MeV was found to be (38 ± 3) percent of the total. (auth)

27788 METHOD TO CORRECT SELF-ABSORPTION WHEN MEASURING THE ACTIVITY OF PLANE SOURCES OF BETA-RADIATION. Kraus, W. (Staatliche Zentrale fuer Strahlenschutz, Berlin); Wojtjiewicz, J. Isotopenpraxis; 8: No. 8, 293-295(Aug 1972). (In German).

A method to correct self-absorption when measuring the activity of plane beta-radiation sources is reported which permits absorption measurements to be carried out at the source. This method implies meeting of some prerequisites which in general are easy to be complied with, after which it is applicable to any measuring equipment and to any given detector. The results of measurements performed with the aid of an end-window counter and two autoradiographic films are presented to show that with self-absorption coefficients ranging between 0.6 and 0.9 the method yields satisfactory results. (auth)

Design and Fabrication

27789 (BNWL-810) FABRICATION OF ^{147}Pm OXIDE COMPATIBILITY CAPSULES. Brite, D. W.; Boolen, R. F. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug 1968. Contract AT(45-1)-1830. 45p. Dep. NTIS $4.25.

Declassified 3 Apr 1973.

The preparation and encapsulation of 19 $^{147}Pm_2O_3$ pellets for use in extended high-temperature tests to determine the compatibility of Pm_2O_3 with various metals are described. Each capsule was comprised of a 16 g sintered Pm_2O_3 pellet, a plug of the metal to be tested for compatibility with Pm_2O_3, a can of the same metal, a secondary Inconel container, and an outer Inconel jacket. Five of the capsules were densified by pneumatic impaction and contain an additional 304 L stainless steel jacket between the primary can and the secondary Inconel container. Nine different metal cladding combinations were included. All 62 closure welds were made in vacuum by electron beam welding. (auth)

27790 (EURISOTOP-55(Vol.2), pp 843-846) COLD LIGHT SOURCES. Invernizzi, C. G. 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Tritium and ^{85}Kr are electron sources which are able to induce cathodoluminescence in certain phosphorescent substances. Since these gases have a half-life of about 12 years, they have yielded a result never before achieved in the warning-light field, for one can be certain of having, for some twelve years, a permanent, failure-proof light signal needing no external energy supply. (TFD)

27791 METHOD FOR THE PREPARATION OF RADIOACTIVE SOURCES. Drabkina, L. E.; Ziv, D. M.; Feofilov, O. G. Russian Patent 270,113. 18 Aug 1970. Filed date 23 Jun 1962. (In Russian).

A method for the fabrication of radioactive sources consisting in the application of the radioactive material on a substrate and the coating of the radioactive material by a protective film of metallic oxide is described. In order to obtain a protective film of metallic oxide as thin as necessary and in order to carry out the application process at room temperature, the radioactive material is applied to the previously oxidized surface of the metallic film. The oxidized side of the film with the radioactive material applied to it is fixed to a metallic or metalloceramic substrate. The non-oxidized metal of the film is dissolved in an aggressive medium. (tr-auth)

Industrial Uses

Refer also to abstracts 27723, 27731, 27846, 27853, and 28279.

27792 (BRH-DEP-73-3, pp 255-268) REGULATIONS GOVERNING RADIOISOTOPES. Malaro, J. C. (Atomic Energy Commission, Washington, DC). Oct 1972.

In radiation safety and protection in industrial applications.

Atomic Energy Commission policies and procedures for licensing and regulating the industrial uses of radioisotopes are discussed. The following areas are reviewed: the source and limitations of the Commission's regulatory authority and the provisions for delegating some of this authority to the States; the regulations which are directly applicable to the industrial use of radioisotopes; the different types of authorizations under which radioisotopes may be possessed and used and the users' obligations under each type of authorization; the Commission's program for evaluating sealed sources and devices; and the Commission's procedures for keeping the public informed. The processing of license applications and how the applicant can insure expeditious handling of his application are described briefly. (LCL)

27793 (BRH-DEP-73-3, pp 283-291) STATE'S ROLE IN INDUSTRIAL RADIATION SAFETY. Gerusky, T. M. (Dept. of Environmental Resources, Harrisburg, PA). Oct 1972.

In radiation safety and protection in industrial applications.

The development of state radiation protection policies and programs is reviewed using the experience of Pennsylvania in regulating and inspecting industrial and medical uses of radiation sources. (LCL)

27794 (BRH-DEP-73-3, pp 293-298) ROLE OF THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

IN INDUSTRIAL RADIATION SAFETY. Karches, G. J. (Dept. of Health, Education, and Welfare, Cincinnati). Oct 1972.

In radiation safety and protection in industrial applications.

The National Institute for Occupational Safety and Health (NIOSH) is concerned with industrial radiation protection for ionizing radiation related to only those ionizing sources in a work place not covered by USAEC regulations, i.e., natural activity, x rays, and isotopes produced from other than reactors and with non-ionizing radiation including microwave, short-wave, and ultrasonic radiation. NIOSH provides assistance to industrial and governmental groups with radiation problems, operates training programs for personnel working with radiation, performs health physics research, and develops criteria for industrial radiation safety standards. Each of these activities is discussed. (LCL)

27795 (EURISOTOP-55(Vol.1), pp 143-162) EXPERIMENTAL STUDY ON THE FLOW MOTION OF FRESH CONCRETE IN SLURRY TRENCH WALLS, USING ACTIVABLE TRACERS. Kawasaki, T.; Ikuta, Y.; Kobayashi, M.; Kawakami, Y. 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

It has been pointed out that in foundation engineering concrete pouring into a slurry trench wall (diaphragm wall) is a most important problem since the concrete pouring work is carried out in bentonite slurry. The presence of slurry decreases the strength of concrete and bond between concrete and reinforcing bars. Tremie methods are generally employed for pouring concrete into the trench wall, but the flow motion of fresh concrete by this method has not been clarified yet, even though this is one of the fundamental factors and is related to the above-mentioned strength phenomena. Activable tracer studies were performed to (1) determine the relation between strength of concrete and amount of slurry contained in the concrete; several tests were carried out under various construction conditions and slurry density using activable tracers in bentonite. (2) Observe the behavior of the fresh concrete during concrete pouring by the tremie method; the flow motion of the fresh concrete was traced by different kinds of activable tracers for each separate part of concrete. Preparatory experiments for the two above-mentioned studies; four activable tracers were chosen, namely Au, Sb, Sc and Sm. The results point out the influence of the presence of slurry on the strength of concrete and the behavior of fresh concrete in the trench wall. (auth)

27796 (EURISOTOP-55(Vol.1), pp 425-435) UNITED STATES PROGRAM ON CONCRETE-POLYMER DEVELOPMENT. Rotariu, G. J.; Miller, L. A. (Atomic Energy Commission, Washington, DC). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The development and potential uses of concrete-polymer materials by various government agencies in cooperation with the USAEC are reviewed. (TFD)

27797 (EURISOTOP-55(Vol.1), pp 465-480) POTENTIAL FOR CONCRETE-POLYMER AND WOOD-POLYMER COMPOSITES IN THE BUILDING INDUSTRY. Welt, M. A. (Radiation Tech., Inc., Rockaway, NJ). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The development and potential uses of concrete-polymer and wood-polymer materials in the building industry are reviewed. The major effort in the wood-polymer field is presently directed towards the production of parquet tile flooring. Other potential uses include window frames, door sets, paneling, partitions, and kitchen cabinets. Concrete-polymer materials are being used in buildings for structural as well as decorative components. (TFD)

27798 (EURISOTOP-55(Vol.1), pp 551-568) POLYMER SUBSTRATE BONDING OBTAINED BY RADIATION IN RESIN-TREATED WOODS. Laizier, J.; Laroche, R.; Marchand, J. 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

The effects of different systems of impregnation have been studied on beech wood in sheets and in cubes. The aim was to find compounds having maximum dimensional stability and permitting utilization of the impregnated wood directly after the irradiation treatment. The advantages of vinyl monomers which have nitrogen atoms in the molecule and swell the ligno-cellulose material were demonstrated. In addition, the presence of water in the mixture or in the form of humidity in the wood was found to be essential. It was shown that the conventional method of preparation of impregnated wood (utilization of a ternary monomer/solvent/water mixture) can be replaced by a method employing comonomers and dispensing with drying of the wood after treatment at the appropriate dose. (auth)

27799 (EURISOTOP-55(Vol. 1), pp 569-593) WOOD-PLASTIC COMPOSITE PARQUET FLOORING. Production Experience, and Economics. Green, W. R. (Atomic Energy of Canada Ltd., Ottawa). 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Experience with a process facility with a capacity of 800 ft^2 per day is described. Economics and design of an automated facility with a capacity of 25,000 ft^2 per day is discussed. (auth)

27800 (EURISOTOP-55(Vol. 2), pp 679-689) DEVELOPMENT OF RADIATION TECHNIQUES IN THE BUILDING INDUSTRY. Pierlas R. (Conservatome, Courbevoie, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Two groups of radiation techniques used in the building industry are described. The first consists of efforts to improve the characteristics of existing materials, particularly their mechanical properties. This may be done either by impregnation in depth with monomers, followed by radiochemical polymerization (procedures leading to new materials such as wood-plastic or resin-impregnated concrete) or by a mass cross-linking for certain plastics, e.g., polyethylene and PVC. Finally, new colors can be developed for vitreous materials, so that with glass pastes, for example, it is possible to reduce the number of basic tints. With most of the above applications gamma radiation is used (notably cobalt-60). The main aim of the second group of applications is to give the materials additional protection against external attack, particularly by atmospheric agents. By the use of low-energy electron accelerators (0.3 to 0.6 keV) it is possible to graft certain monomers onto unsaturated polymers in the cold state. This technique can easily be fitted into a continuous production chain. The backing used can be either thin aluminium sheets, panels of particles or plates of asbestos cement. The varnishes, paints or coatings applied must be chosen with a view to the nature of the backing, the mechanical properties desired, and the final environment of the material. (auth)

27801 (EURISOTOP-55(Vol. 2), pp 699-713) ELECTRON BEAM CURING OF INDUSTRIAL SURFACE COATINGS. Batsberg Pederson, W.; Singer, K. 1972.

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Experimental work on electron beam curing of coatings based on modified acrylics and polyesters is reported. (TFD)

27802 (EURISOTOP-55(Vol. 2), pp 817-842) CURRENT USES OF RADIOISOTOPES IN GAZ de FRANCE. Tellier, C. 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Gas of France employs radioelements systematically on its sites. For example, bromine-82 is used to determine the fuel-brine interface in cavities in saline structures created by leaching with a view to store natural gas under pressure (200 bars). Accuracy to within 20 cm is obtained. Leakages can be detected in gas distribution networks by $^{82}Br\ CH_3$, a method successfully transposed to transport networks. A conventional gammagraphy technique is used for the inspection of steel tube welds. The method has been applied to the study of earthenware chimneys liable to "flue sweating" even after having been lined by applying mortar. Three characteristic faults were revealed, namely, incorrect earthenware jointing and cracking and irregular thickness of seals. Krypton-85 is used to measure the air exchange rate in order to gage the ventilation for expansion chambers (a few m^3) and compressor stations (500 to 1000 m^3). For large spaces (1000 m^3 and above) the velocity of the air in an air duct is determined. In the same way, ^{85}Kr can be injected into a furnace while in operation in order to locate the points of exchange of gas with the ambient air. (auth)

27803 (EURISOTOP-55(Vol. 2), pp 1151-1186) APPLICATION OF RADIOELEMENTS AND RADIOACTIVE RADIATIONS IN BUILDING AND PUBLIC WORKS. Toyer, M. (Centre Scientifique et Technique du Batiment, Champs-sur Marne, France). 1972. (In French).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

Applications of radioelements and ionizing radiations have developed considerably in recent years, particularly in the construction industry. These applications range through very varied industrial sectors, from basic fabrications (cement, concrete, metal structures, plastics, etc.) to actual construction. They find uses in the inspection of materials (radiography of concretes, and density and humidity measurements on loose materials), the inspection of industrial processes with radioactive tracers (calcination of cement), information on installations (ventilation etc.), markings during production (Hepper levels), improvement of existing products, and in the creation of new products, i.e., plas-

tics, wood plastic, concrete plastic. The main techniques currently used in the building industry are discussed. (auth)

27804 ELECTRON RADIATION STERILIZATION. Description and Operation of an Industrial Sterilization Unit. Icre, P. (Centre d'Application des Rayonnements Ionsants, Orsay, France). Ind. At. Spatiales; 16: No. 5, 39-51(Sep 1972). (In French and English).

The advantages of radiosterilization are discussed together with its industrial development. The bactericidal action of radiations and the doses to be given are studied. An industrial radiosterilization unit (Caric) is described. It is provided with a 4 to 6 MeV electron accelerator (CIRCE 10). The specifications and performance of this accelerator are given. The operating conditions were established: irradiation parameters, yield, rate of operation and operating capacity, measurements, and monitoring. (FR)

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27805 (AEC-tr-7415, pp 109-115) SOME MODELS OF THE PROCESS OF POSTRADIATION RECOVERY. Dankov, G. Yu.; Logofet, D. O. (Moscow State Univ.). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 717-722(1972).

A special type of stochastic Markov models of the process of postradiation recovery is constructed. A Markov circuit, which represents a linear process of death, is suggested as the first model, which does not consider the irreversible component of radiation lesion. It was shown that in this case recovery occurs according to the type of a reduction of the "effective dose." In the construction of the second model, a postulate considering the irreversible component of radiation lesion was introduced, and the first model was modified in accord with this. An equation was obtained, describing the decrease in the "effective dose" as a function of the time of recovery. (tr-auth)

Radiation Effects on Biochemicals

Refer also to abstracts 27421 and 27929.

27806 (AEC-tr-7415, pp 27-32) INFLUENCE OF IONIZING RADIATION ON CERTAIN REGULATORY PROPERTIES OF LYSYL-tRNA SYNTHETASE FROM THE RAT LIVER. Khanson, K. P.; Shutko, A. N.; Petrova, L. D. (Central Scientific Research Inst. of Roentgeno-Radiology, Leningrad). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 654-658(1972).

The influence of x radiation in vitro and in vivo on the process of regulation of lysyl-tRNA synthetase (lysyl-RSase) from the rat liver and the ratio of adenylic nucleotides (Atkinson "energy charge") was investigated. Irradiation of solutions of the enzyme at a dose of 30 krad had no effect on the activity and regulatory functions. At the same time, lysyl-RSase, isolated from the rat liver 24 hrs after total irradiation at doses of 800 and 1500 rad, is characterized by a decrease in the catalytic activity and a loss of the ability to be regulated by the "energy charge." The mechanism of the action of radiation on the enzyme and the possible role of SH groups in its damage are discussed. (tr-auth)

27807 (AEC-tr-7415, pp 140-145) VIBRATIONAL SYSTEMS OF VARIATION OF THE SURFACE PRESSURE OF MONOMOLECULAR LAYERS OF SERUM PROTEINS, SUBJECTED TO THE INFLUENCE OF IONIZING RADIATIONS. Tkach, V. K.; Dyakov, V. A. (Vinnitsa Medical Inst., USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 742-746(1972).

The vibrational systems of variation of the surface pressure of monomolecular layers of native and γ-irradiated (30 kR) serum albumins and γ-globulins were investigated. It is shown that in irradiated proteins the fluctuation of the surface pressure is inhibited in comparison with the native proteins. (tr-auth)

27808 PHOTOALKYLATION OF PURINES IN DNA. Ben-Ishai, R. (Technion-Israel Inst. of Tech., Haifa); Green, M.; Graff, E.; Elad, D.; Steinmaus, H.; Salomon, J. Photochem. Photobiol.; 17: No. 3, 155-167(Mar 1973).

Ultraviolet light irradiation of DNA in the presence of alcohols such as 2-propanol leads to hydroxyalkylation of the purine bases. The purine photoproducts were identified as C-8 hydroxyalkyl derivatives of adenine and guanine by chromatographic mobility, co-crystallization with authentic samples, and by photoreversal to the original purines. Experiments are reported that demonstrate that the photoalkylation reaction is dependent on secondary structural alterations in DNA. It is suggested that the photoalkylation of purines proceeds through free radical intermediates. The presence of alcohols during irradiation considerably decreases pyrimidine-dimer formation. (auth)

27809 EFFECT OF HIGH DOSES OF GAMMA RADIATION ON BIOPOTENCY OF ATROPINE SULPHATE. Natarajan, S.; Jain, S. K. (Inst. of Nuclear Medicine and Allied Sciences, Delhi). Indian J. Med. Res.; 60: 1452-1460(10 Oct 1972).

As part of the programme of studying the effects of high doses of gamma irradiation on commonly used drugs and pharmaceuticals, the biopotency of atropine sulfate solution was investigated. Atropine sulfate was exposed to several dose levels of gamma radiation (0.5 to 3.0 MR at dose rates of 65 R/sec) in the dry state and in aqueous solution and in the presence and absence of N_2 atmosphere. Chemical changes were followed by changes in pH, and uv absorption spectra. Biological activity was assessed by the antagonistic action to acetylcholine on isolated ileum of rats. Atropine sulfate was resistant to chemical or biological change in activity when irradiated in dry state. In aqueous solution however, doses as low as 0.5 MR produced significant loss in biological activity and complete loss of activity when 3 MR. Attempts were made to prevent degradation. Solutions were prepared with AET, cysteamine, sodium bisulfite, and sodium metabisulfite. Some measure of success was achieved especially with the sodium metabisulfite addition. (auth)

27810 RADIOSENSITIVITY OF INVERTASE TO GAMMA RADIATION IN VITRO AND IN VIVO. Giacomelli, M.; Belli-Donini, M. L. (CNEN, Rome). Agrochimica; 16: No. 4-5, 330-335(1972). (In Italian). (RT/BIO-(72)70).

Invertase aqueous solutions at the concentrations of 0.05, 0.1, 0.3, 1.0, and 5.0 γ/ml were irradiated with gamma and x rays at doses of 1, 5, 10, 15, 30, 50, 100, and 200 krads. At the same time, sugarbeets at different periods from harvest were irradiated at doses of 50, 100, 150, 175, and 200 krads. Enzymatic activity was measured by the Hugget-Nixon method. A rapid decrease in enzymatic activity was noted with doses up to 5 krads for the water solutions for all concentrations. This behavior is a characteristic of the direct and indirect effect of radiation in a biologically active molecule. The highest effect was reached at the highest concentration as the G-value showed. To explain this phenomenon a hypothesis is presented. Total doses up to 5 krads gave an almost constant enzyme inactivation meaning an independent dose-effect relationship. The lower sensitivity of the enzymatic activity, which was found in vivo system, may be explained both in terms of lower energy received by the molecule or by a higher protection of the enzyme. (auth)

27811 RADIATION QUALITY: A THEORY OF ACTION OF IONIZING RADIATIONS ON DNA, MICROORGANISMS, AND MAMMALIAN CELLS. I. General Outline and Some Results. Guenther, K.; Schulz, W. (Central Inst. of Molecular Biology, Berlin). Stud. Biophys.; 34: No. 3, 165-188(1972).

A quantitative theory of radiation action is presented that connects the physical features of energy deposition in relation to radiation quality with the concrete biological structure of the given object by presuming only DNA-lesions to account for the radiation effect under consideration. Since the required mathematics is rather complicated, this paper deals only with the general formulation of the theory and with some of its results, illustrating the possibilities of application and the kind of information that it allows to be drawn from experiments. (auth)

27812 SUSCEPTIBILITY OF BOVINE, CANINE, AND OVINE α-CRYSTALLINE TO γ-IRRADIATION. Ferguson, W. E.; Koenig, V. L. (Univ. of Texas, Galveston). Comp. Biochem. Physiol.; 44B: No. 1, 163-178(15 Jan 1973).

Irradiation of lyophilized native α-crystallins with γ rays produced insolubility, fragmentation, and aggregation as revealed by sedimentation, and changes in viscosity. α-Crystallin solutions irradiated at 2 and 4% protein concentrations exhibited fragmentation, aggregation, and increases in viscosity. Canine α-crystallin was the most susceptible to irradiation when lyophilized and in 4% solution, whereas bovine α-crystallin was the most susceptible in 2% solution. Alkaline-modified bovine α-crystallin, already altered, showed little change with increasing irradiation dosage when lyophilized and in solution. α-Crystalline appeared to be two to three times as susceptible to irradiation as are bovine fibrinogen and serum albumin. (auth)

27813 RADIATION EFFECTS INDUCED BY γ-RADIATION OF PYRIMIDINES IN WATER SOLUTIONS. Pletikha-Lanskii, R. (Inst. of Experimental Botany, Prague). Tsitol. Genet.; 6: No. 5, 400-409(1972). (In Russian).

Investigations using polarography, oscillopolarography, chromatography, and ^{14}C-labeled pyrimidines showed that as a result of γ irradiation of aqueous solutions of cytosine and uracil there appear isobarbituric, 4,4'-diisobarbituric, isodialuric acids, and the system dialuric acid + alloxan $\rightleftharpoons$ alloxantin. Further, as a result of their hydrolysis, parabanic and oxaluric acids are formed. Mechanisms of the corresponding chemical and radiation-chemical processes are discussed. (auth)

27814 CONTRIBUTION OF VARIOUS TYPES OF DAMAGE TO INACTIVATION OF A BIOLOGICALLY-ACTIVE DOUBLE-STRANDED CIRCULAR DNA BY GAMMA-RADIATION. van der Schans, G. P.; Bleichrodt, J. F. (Rijksverdedingsorganisatie TNO, Rijswijk, Netherlands). Int. J. Radiat. Phys. Chem.; 23: No. 2, 133-150(Feb 1973).

The double-stranded circular DNA of the bacteriophage PM2 was irradiated in oxygenated solution by ^{60}Co gamma rays. The following quantities were determined as a function of dose: The average number of single-strand breaks and that of double-strand breaks

per molecule, the biological activity of the irradiated sample as such, the biological activity after mild denaturation (to denature molecules containing a break), and the biological activity after denaturation and membrane filtration (i.e., the biological activity of DNA without single- and double-strand breaks). From the collected data it could be deduced that 4.5 ± 0.5% of the inactivation was a consequence of double-strand breaks, 8.5 ± 4.2% of single-strand breaks, and 87.0 ± 4.2% of nucleotide damage. Only about 2% of the single-strand breaks was lethal, whereas the efficiency of inactivation of nucleotide damage was about 30% of the nucleotide damage which is lethal if present in single-stranded DNA. Preliminary experiments with circular double-stranded RF-DNA of bacteriophage ϕX174 gave similar results. (auth)

27815 CHARACTERISTICS OF PROTEIN THIOL GROUPS ON THE GROUND OF THEIR REACTING WITH β-HYDROXYETHYL 2,4-DINITROPHENYL DISULPHIDE. II. Effects of γ-^{60}Co Radiation on SH Groups of H-Meromyosin. Bitny Szlachto, S. (Inst. of Hygiene and Epidemiology, Warsaw). Acta Pol. Pharm.; 29: No. 5, 453-458(1972). (In Polish).

In H-meromyosin irradiated with 10 to 45 krad of ^{60}Co-γ radiation and in control samples of the protein there were determined: the total SH assayed in the presence of 4.5 H urea, and SH of the native protein, reacting with 0.375 mM β-hydroxyethyl 2,4-dinitrophenyl disulphide (HEDD). Resolution of the time-course of the latter reaction into components, corresponding to reactions of particular types of thiol groups, gave contents of SH^{I}, SH^{II}, and SH^{III} having under applied conditions half-reaction periods 20 to 50 min, 2 to 7 min, and below 2 min, respectively. Irradiation of the protein proved to reduce the content of SH by 0.28 μEq/krad per gram protein. Moreover, a slight increase in the content of the most reactive type of thiol groups (SH^{III}), ascribed to denaturation of the protein by irradiation, distinct decrease of content of SH^{II}, and less pronounced drops in contents of either SH^{I} and masked thiol groups were demonstrated in the irradiated protein. (auth)

27816 RADIATION DAMAGE AND REPAIR PHENOMENA. Fox, B. W.; Lajtha, L. G. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Brit. Med. Bull.; 29: No. 1, 16-22 (Jan 1973).

Trends in research into radiation damage and repair phenomena are reviewed in outline under the following headings: Nature of damage in DNA, base damage, strand breakage, inter-strand and intra-strand crosslinking; repair processes, incision near the damage, excision, non-semiconservative DNA synthesis, strand rejoining, post-replication and recombination repair; effect of different agents on the induction of breaks and their repair; and consequences of repair failure. (UK)

27817 CLUSTERING OF THYMINE DIMERS IN ULTRAVIOLET IRRADIATED DNA AND THE LONG-RANGE TRANSFER OF ELECTRONIC EXCITATION ALONG THE MOLECULE. Shafranovskaya, N. N.; Trifonov, E. N.; Lazurkin, Yu. S.; Frank-Kamenetskii, N. D. (Inst. of Atomic Energy, Moscow). Nature (London) New Biol.; 241: No. 106, 58-60(10 Jan 1973).

A simultaneous determination of the number of locally denatured regions and that of thymine dimers was carried out in ultraviolet irradiated T2-phage DNA. Chromatographic techniques were applied to acid hydrolysates of ultraviolet irradiated DNA to determine the number of thymine dimers labelled with ^{14}C thymidine. Locally denatured regions were established by means of the kinetic formaldehyde method. Data are presented showing that the thymine dimers in the ultraviolet irradiated DNA molecules are arranged in compact clusters, each forming one local denatured region. The degree of clustering was studied as a function of irradiation dose and its value γ dropped with decreasing dose, approaching 1 ± 0.5 when irradiation dose tended to zero. Effective clustering took place with increasing dose, reaching a value of $\gamma \approx 6$ dimers/defect at the irradiation dose of 3,000 ergs/mm^{-2}. It is suggested that initially there is formation of separate dimers arising at locally denatured sites induced by thermal fluctuations. When the mean distance between the defects (dimers) approaches the free path length of excitation (as determined by the probability of utilization of its energy in the dimerization process at sites of thermal fluctuations), the dimerization begins to proceed preferentially near the dimers formed earlier, and clustering takes place. Saturation and subsequent decrease of the degree of clustering could be explained as a consequence of the exhausting of potential dimers in the close vicinity of growing clusters, and the decrease of γ at large doses could be connected with the process of dimer monomerization under ultraviolet irradiation. (auth)

Radiation Effects on Cells

Refer also to abstracts 27857, 27862, 27929, and 27959.

27818 (AEC-tr-7415, pp 99-108) EVALUATION OF THE POSSIBLE INFLUENCE OF THE TIME FACTOR ON THE RELATIVE BIOLOGICAL EFFECTIVENESS OF IONIZING RADIATIONS. Kapul'tsevich, Yu. G.; Parfenov, E. N. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 708-716(1972).

The hypothesis that the change in the biological effectiveness of radiations with increasing ionization density is determined by recovery of the cells from damages is discussed. It is suggested that one ionization is sufficient for the formation of the primary damage. The probability of realization in each damage that has arisen in the cell decreases exponentially with time if the total number of damages does not exceed some critical value. As soon as the number of damages reaches this threshold, the cell is inactivated, and repair processes stop. On the basis of these hypotheses, the survival curves of cells, the inactivation of which necessitates two, four, and eight damages, after irradiation with particles forming different numbers of primary ionizations per unit track length, were calculated on the basis of these hypotheses. It was shown that in the case of sufficiently intensive recovery, the effectiveness of radiations may increase with increasing ionization density. However, the nature of this increase and the expected value of the effect of the dose rate contradict the corresponding experimental results with mammalian cells in culture and with haploid yeasts, described in the literature. (tr-auth)

27819 (COO-3229-3) RADIOTOXICITY OF ^{125}I IN MAMMALIAN CELLS: DIVISION DELAY IN SUSPENSION CULTURES. Technical Progress Report. Adelstein, S. J. (Harvard Medical School, Boston, Mass.). 1972. Contract AT(11-1)-3229. 11p. Dep. NTIS $3.00.

Irradiation of Chinese hamster ovary cells, grown in suspension, with x-irradiation produced a dose related mitotic delay of 1.6 hours per 100 R exposure. Incubation of CHO cells with ^{125}IUdR at a concentration of 2.5 nCi/ml in the medium produced a 1.3 hour delay, while concentrations of 12.5 and 125 nCi/ml produced a division delay in excess of five hours. (auth)

27820 CYTOTOXICITY AND MUTAGENICITY OF ULTRAVIOLET IRRADIATION AS A FUNCTION OF THE INTERVAL BETWEEN SPLIT DOSES IN CULTURED CHINESE HAMSTER CELLS. Thilly, W. G.; Heidelberger, C. (Univ. of Wisconsin, Madison). Mutat. Res.; 17: No. 2, 287-290(Feb 1973).

Cultured hamster cells were uv-irradiated at a dose of 20 erg/mm^2 and exposed to a second identical dose at intervals up to 24 h. Thirty h after the second dose, the selective condition of 10 μg/ml of 8-AzG was applied. The results are expressed as the number of 8-AzG resistant colonies per 10^5 surviving colonies. The results of cytotoxicity are expressed as the percent survival compared to unirradiated controls. A striking increase in cytotoxicity and mutagenicity was observed at intervals of 15, 30, and 60 min; at intervals of 3h or greater, cytotoxicity and mutagenicity decreased with increasing intervals between doses. (HLW)

27821 RELATIVE RADIOSENSITIVITIES OF TETRAPLOID AND DIPLOID CHINESE HAMSTER CELLS IN CULTURE EXPOSED TO IONIZING RADIATION. Burki, H. J. (Univ. of California, Berkeley); Carrano, A. V. Mutat. Res.; 17: No. 2, 277-282(Feb 1973).

Culture of tetraploid and diploid hamster cells were x-irradiated and incubated at 37°C in order to form visible colonies. The number of metaphase chromosomes in each of 100 cells was determined for the two strains. The model chromosome numbers were 44 and 23. Survival data showed that at a dose of less than 600 rad the tetraploids were more resistant while at higher doses the diploids were more resistant. Results suggested that genetic damage is important in the events that lead to reproductive death in mammalian cells. (HLW)

27822 CHROMOSOME ABERRATIONS IN PERIPHERAL LYMPHOCYTES OF MEN EXPOSED IN VITRO TO 645 MeV PROTON- AND X IRRADIATION. Ryuzhov, N. I.; Totseva, A. M.; Govorun, R. D.; Malyutina, T. S.; Gerasimenko, V. N. Kosm. Biol. Med.; 7: No. 2, 79-83(1973). (In Russian).

Lymphocytes of the human peripheral blood in the presynthetic phase of the mitotic cycle were irradiated in vitro with 645 MeV protons and x rays at dosages of 25 to 400 rads. The tabulated data demonstrate no differences in the induction of chromosome aberrations by protons and x rays. (auth)

27823 CHANGES IN THE RATE OF RADIOINDUCED MITOSIS REDUCTION WITH FRACTIONATED RADIATION. Kaufmann, H.; Schmitz, H. (Ruhr-Univ., Bochum, Ger.). Radiol. Clin. Biol.; 41: No. 3, 183-189(1972). (In German).

The course of radioinduced mitosis reduction gives an insight into the radiation injury and subsequent recovery of growing tissue. Fractionated radiation of Ehrlich ascites tumor cells shows that after a second radiation dose, given at the time of morphological

recovery of mitosis activity (after a first radiation dose) the mitosis reduction is of the same duration, but the mitosis rate increases more slowly. This can be explained by a still incomplete recovery of the capacity of the repair system. These findings seem to be of importance for the construction of models for the analysis of recovery processes in radiation biology. (auth)

27824 GENETIC HAZARDS OF IONIZING RADIATIONS: CYTOGENETIC EXTRAPOLATIONS FROM MOUSE TO MAN. Brewen, J. G.; Preston, R. J.; Jones, K. P.; Gosslee, D. G. (Oak Ridge National Lab., TN). Mutat. Res.; 17: No. 2, 245-254(Feb 1973).

The frequencies of x-ray-induced asymmetrical interchanges (dicentrics) and acentric fragments (deletions) at several doses were measured in the circulating leukocytes of six species. The leukocytes of the species used had similar DNA contents but different chromosome and chromosome arm numbers. The data for dicentrics were fitted separately for each species by regression analysis to the model $Y_j = b_jD + c_jD^2$. All species gave a good fit to this model. As expected, when the dicentric data for all species were pooled and fitted to this model a poor fit was obtained. However, if a term for arm number was included, so that the model $Y_j = (N_j - I)\ (bD + cD^2)$ was fitted, a significant amount of the variation among species could be accounted for. At each dose there was an approximately linear relationship between the yield of dicentrics and the arm number. Man, with an effective arm number of 81, had twice as many dicentrics as the mouse, with an effective arm number of 40. These results strongly suggest that the chromosome arm number of a species influences the yield of asymmetrical interchanges. The chromosome arm number did not appear to influence the yield of deletions, and the yields induced in the mouse and man at each dose were equal. These results show that man is twice as sensitive as the mouse to the induction of translocations, whereas the two species are equally sensitive to the induction of deletions and, in all probability, to the production of mutations. (auth)

27825 PHOTOREACTIVATION AND REPAIR REPLICATION IN RAT KANGAROO CELLS. Krishnan, D.; Painter, R. B. (Univ. of California, San Francisco). Mutat. Res.; 17: No. 2, 213-222 (Feb 1973).

Potorous tridactylis cells can perform photoreactivation, i.e., the visible light-catalyzed reversal of uv-induced pyrimidine dimers in DNA. Uv-induced inhibitions of total RNA and DNA synthesis can also be partially reversed by exposure to visible light. P. tridactylis cells can also perform repair replication, but the extent of the latter is reduced if the cells are exposed to visible light (VL). None of these effects are observed in mouse L cells, which cannot perform photoreactivation. The results are consistent with the concept that pyrimidine dimers are one of the main substrates for repair replication. (auth)

27826 SENSITIVE METHOD FOR THE IN VITRO DETECTION OF VERY SMALL X-RAY DOSES. Arky, I. (National Inst. of Haematology and Blood Transfusion, Budapest). Haematologic (Budapest); 5: No. 1-2, 97-98(1971).

A procedure was worked out to detect the biological effect of small x-ray doses by a simple in vitro method. (auth)

27827 EFFECT OF IONIZING RADIATION ON NUCLEAR ENERGY TRANSDUCTION IN NORMAL AND NEOPLASTIC GLIA. A Quantitative Cytochemical Investigation. Kirsch, W. M.; Schulz, D.; Fuchs, E.; Nakane, P. (Univ. of Colorado, Denver). Acta Radiol., Ther., Phys., Biol.; 11: No. 4, 349-360(Aug 1972).

The immediate effects of ionizing irradiation on measured energy reserves (ATP, PCr) in subcellular compartments of normal murine brain and glioblastoma in cell culture. Determination of these effects is made feasible by application of a new method for tissue fixation employing rapid freezing, lyophilization, and subsequent isolation in high purity of lyophilized nuclei. The immediate effect of irradiation on normal murine brain is a significant lowering of steady-state cytoplasmic ATP, enhanced cytoplasmic glycolysis, with minimal changes in the nuclear energy charge. These results are to be contrasted with immediate irradiation effects in the glioblastoma; namely a slight rise in cytoplasmic ATP, but loss of nuclear energy reserves. The latter observation implies the presence of a radiosensitive ATP generating system in glioblastoma nuclei. (auth) (Sweden)

27828 CHEMICAL RADIOSENSITIZATION OF HYPOXIC CELLS. Adams, G. E. (Mount Vernon Hospital, Northwood, Eng.). Brit. Med. Bull.; 29: No. 1, 48-53(Jan 1973).

Research into the chemical radiosensitization of hypoxic cells is reviewed in outline under the following headings: (1) criteria for the successful application of chemical radiosensitization in radiotherapy; (2) the classification of radiosensitizers (suppression of SH groups e.g. by N-ethylmaleimide, NEM), formation of toxic radiation products (e.g. Cu^{2+}, iodoacetamide, inhibition of post-irradiation processes (e.g. Actinomycin, 2,4-dinitrophenol), structural incorporation of thymine analogues such as BUdR, oxygen mimics (e.g. TAN); (3) electron-affinic sensitizers such as diacetyl, the glyoxals and quinones, p-nitroacetophenone (PNAP) and its derivatives, the nitrofurans; sensitization of hypoxic mammalian cells in vivo; sensitization of hypoxic mammalian cells in vitro. (UK)

Radiation Effects on Microorganisms

Refer also to abstracts 27804 and 27929.

27829 (AEC-tr-7415, pp 116-124) EFFECTS OF ULTRAVIOLET RADIATION ON AN ASYNCHRONOUS CULTURE AND ON VARIOUS STAGES OF THE VEGETATIVE CELLULAR CYCLE OF A SYNCHRONOUS CULTURE OF CHLAMYDOMONAS REINHARDI. Ladygin, V. G.; Burikov, E. A. (Inst. of Biological Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 723-729(1972).

The results of a study of survival and the frequency of induced mutations under the action of uv radiation on cells of an asynchronous culture and on various stages of the vegetative cellular cycle of a synchronous culture of Chlamydomonas reinhardi are presented. It was shown that the greatest sensitivity distinguishes the cells of the presynthetic period, while the cells of the presynthetic (in the case of photoreactivation) and beginning of the synthetic (without photoreactivation) periods of the vegetative cellular cycle are distinguished by the greatest mutability. Photoreactivation substantially reduces both the lethal and the mutagenic effects of uv radiation. After the influence of uv radiation on cells of this alga, a substantial delay of cell divisions is observed. (tr-auth)

27830 (AEC-tr-7415, pp 184-192) ELECTROKINETIC INVESTIGATIONS OF GAMMA-IRRADIATED MICROBIAL CELLS. Kononenko, K. I.; Chaikina, L. A. (Khar'kov State Univ.). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 774-780(1972).

The modifying influence of ionizing radiation on the electrophoretic mobility of microbial cells depends on the composition and properties of the medium used for the suspension (type of buffer solution, its pH), as well as the value of the surface electric charge; the change in the charge during irradiation in turn depends on the chemical composition of the cell surface or on the preliminary influence of copper nitrate or erythromycin on the cells. The role of the charge in the postradiation distrubance of the ionic permeability and in the increase in its stability to the action of radiation is discussed. (tr-auth)

27831 (AEC-tr-7415, pp 197-200) EXPERIMENTAL SUBSTANTIATION OF THE USE OF ALTERNATE HOST LAYERS FOR DETERMINING THE SURVIVAL OF COMPLEXES OF UV-IRRADIATED PHAGE AND BACTERIA. Mosin, A. F.; Petrova, K. M.; Tsyb, T. S. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 783-785(1972).

In the uv irradiation of bacteriophages, a method in which phage-infected cells of one strain (for example, E. coli B) are inoculated onto a bacterial layer consisting of homologous bacteria (E. coli B_{s-1}) is frequently used (without experimental substantiation). The data of this work provide an experimental substantiation of the validity of such a method in radiobiological experiments. These data show that complexes with firmly sorbed phage survive with equal probability on hcr^+ and hcr^- layers. (tr-auth)

27832 RADIATION STERILIZATION OF PROTOTYPE MILITARY FOODS: LOW-TEMPERATURE IRRADIATION OF CODFISH CAKE, CORNED BEEF, AND PORK SAUSAGE. Anellis, A.; Berkowitz, D.; Swantak, W.; Strojan, C. (Army Natick Labs., MA). Appl. Microbiol.; 24: No. 3, 453-462(Sep 1972).

Screening packs comprising 10 lots each of codfish cake, corned beef, and pork sausage, each lot containing about 10^8 spores of a different strain (five type A and five type B) of Clostridium botulinum per can, were irradiated at $-30 \pm 10°C$ with a series of increasing doses (20 replicate cans/dose) of ^{60}Co γ rays. The cans were incubated for three months at 30 C and examined for swelling, toxin, and recoverable botulinal cells. Based on the latter criterion of spoilage, median lethal dose (LD_{50}) and D values were estimated for each strain in each food. The most resistant strain in codfish cake, corned beef, and pork sausage was, respectively, 53B, 77A, and 41B. There was no clear-cut trend in the comparative order of resistance between the two antigenic types among the three foods. LD_{50} values gave essentially the same order of resistances as the D values and may be used interchangeably with the latter for the 10 test organisms. Clearance packs consisting of the most resistant strain (about 10^7

spores/can) with its respective food were irradiated with a variety of doses at −30 ± 10°C, using 100 replicate cans/dose (about 10^9 spores/dose). These packs were incubated for 6 months at 30 C and assayed for the three types of spoilage. Based on recoverable cells, the experimental sterilizing doses (ESD) for codfish cake, corned beef, and pork sausage were $2.5 < ESD \leq 3.0$, $2.0 < ESD \leq 2.5$, and $1.5 < ESD \leq 2.0$ Mrad, in that order. Assuming exponential spore death, the 12D values, or minimal radiation doses (MRD), were 3.24, 2.44, and 2.65 Mrad, respectively. Estimation of the MRD values by a method which assumes that spore death in the cans follows a normal distribution, yielded 3.09, 2.57, and 2.39 Mrad, respectively. Weibull analysis of the pooled 10-strain viable cell spoilage data of the screening packs for codfish cake or corned beef suggested that spore death in the cans follows a normal distribution yielded 3.09, 2.57, pooled data were not amenable to such analysis. Sublethal doses (0.5, 0.75 Mrad) increased the visible spoilage rate of corned beef over that of unirradiated controls. Apparently radiation-injured spores of C. botulinum were sensitized to the presence of food additives such as curing salts, NaCl, and spices. (auth)

27833 TRYPANOSOMA CONGOLENSE: IMMUNIZATION OF MICE, DOGS, AND CATTLE WITH GAMMA-IRRADIATED PARASITES. Duxbury, R. E.; Anderson, J. S.; Wellde, B. T.; Sadun, E. H.; Murithi, I. E. (Walter Reed Army Inst. of Research, Washington, DC). Exp. Parasitol.; 32: No. 3, 527-533(1972).

In a series of experiments involving 21 groups of mice, between 50 and 100 per cent of those inoculated with irradiated Trypanosoma congolense were completely protected from challenge inoculations of unirradiated T. congolense. Of 37 mice given a second or third challenge after 9 and 26 weeks, 23 remained parasite-free. Unimmunized control mice invariably developed parasitemias and most of them died as a result of the infection. Dogs and cattle failed to withstand challenge inoculations after they were treated with irradiated trypanosomes, though prepatency in these animals was longer than that of the controls. (auth)

27834 EFFECT OF DIPICOLINIC ACID ON THE ULTRAVIOLET RADIATION RESISTANCE OF BACILLUS CEREUS SPORES. Germaine, G. R.; Murrell, W. G. (Commonwealth Scientific and Industrial Research Organization, Ryde, Australia). Photochem. Photobiol.; 17: No. 3, 145-154(Mar 1973).

The untraviolet radiation (uv) resistance of Bacillus cereus spores was shown to depend on their content of dipicolinic acid (DPA). Wild-type spores with decreasing amounts of DPA exhibited increased uv resistance. Similarly, spores devoid of DPA (DPA-minus), produced by a mutant strain of B. cereus unable to synthesize DPA, were more resistant to uv than mutant spores (DPA-plus) produced in the presence of exogenously supplied DPA. Resistance of both the wild type and mutant strains to ionizing radiation, however, was unaffected by DPA content. Comparison of the resistance of DPA-minus and DPA-plus mutant spores to uv of various wavelengths showed that the greater sensitivity of the latter DPA-plus spores appeared at wavelengths corresponding to the region of the first molecular absorption band of the calcium chelate of DPA. In the wild type and mutant, thymine photoproducts were produced at a greater rate and to a greater extent in spores with high levels of DPA than in spores with low DPA. The data indicate that DPA transfers energy to DPA in vivo, which leads to the conclusion that DPA occurs in the spore protoplast. (auth)

27835 ULTRAVIOLET REACTIVATION OF LAMBDA PHAGE. Assay of Infectivity of DNA Molecules by Spheroplast Transfection. Ogawa, H.; Tomizawa, J. (Osaka Univ.). J. Mol. Biol.; 73: No. 4, 397-406(5 Feb 1973).

Prior irradiation of non-lysogenic bacteria (strains of Escherichia coli) by ultraviolet light led to an increase in the viability of infecting irradiated λ phage (ultraviolet reactivation). Similarly, uv irradiation of wild type or uvrD bacteria lysogenic for λcIind⁻ increased the fraction of closed circular duplex phage DNA molecules formed after infection with uv-irradiated λ phage. The closed circular molecules isolated from the irradiated lysogens were shown to be free from uv damage by a spheroplast transfection assay. The increase of closed circular molecules is sufficient to explain the ultraviolet reactivation observed by the increase of viability of irradiated phage. In ultraviolet reactivation, damage must be erased on irradiated DNA molecules and the repair independent of total replication of phage genomes, exchange of sister chromatids or recombination between phage genomes. Protein synthesis is necessary to increase the level of closed circular molecules of irradiated λ phage after irradiation of bacteria. (auth)

27836 RADIO-MUTAGENESIS OF PHYTO- AND ENTOMOPATHOGENIC FUNGI. Andreev, S. V.; Evlakhova, A. A.; Kirsanova, R. V.; Levitin, M. M. (All-Union Scientific-Research Inst. for Defense Plants, Leningrad). Tsitol. Genet.; 6: No. 5, 395-399(1972). (In Russian).

Data are presented on the lethal and mutagenic effect of uv and x rays on flax polysporosis agent Pullularia pullulans (De Bary) Berkh. and entomopathogenic fungus Beauveria bassiana (Balls) Vuill. New morphological and biochemical mutants were induced. Optimal radiation doses were established for the mutants yield. (auth)

27837 REPARATION AND MUTAGENESIS. II. Photoreactivation of Premutational Damages and the Test of Complementation of UV-Induced Mutations in Ad_2 Locus in UVS_1 and Wild Type Strains of Saccharomyces Cerevisiae. Fedorova, I. V.; Koval'tsova, S. V. (Inst. of Nuclear Physics, Leningrad). Genetika; 9: No. 2, 112-119(Feb 1973). (In Russian).

Ultraviolet-induction and photoreactivation of lethal and premutational damages resulting in ad_2 and ser^r mutations were examined in uv-sensitive uvs_1 and wild-type strains. Frequencies of uv-induced mutation in the uvs_1 strain under equal doses of uv were always higher than in the wild-type strain. Since photoactivation effectively removed lethal and mutational damages in the uvs_1 strain, these damages were considered to be pyrimidine dimers. In the wild-type strain photoreactivation removed mutational damages efficiently at low doses; at higher doses the amount of photoreactivable damages decreased. The test of complementation of uv-induced mutations in ad_2 locus detected no significant differences between various mutational types in uvs_1 and wild-type strains. (auth)

27838 GENETIC INSTABILITY OF RADIOSENSITIVE MUTANT OF YEAST. Kozhina, T. N. (Inst. of Nuclear Physics, Leningrad). Genetika; 9: No. 2, 120-126(Feb 1973). (In Russian).

The effect of the mutation to radiosensitivity xrs_1 on the stability of genetic material in mutant yeast Saccharomyces cerevisiae in the absence of any irradiation was studied. The radiosensitive diploid that was heterozygous for the mutations to adenine-dependence exhibited the high frequency of segregation of recessive markers. The rate of growth was lowered and the frequency of segregation of lethal sectors was increased in radiosensitive haploid and diploid carrying the mutation xrs_1. The mutation xrs_1 significantly increased the frequency of forward mutations in loci ad_2. Using the method of interallelic complementation for 22 spontaneous mutants in the locus ad_2 the genetic map of this locus was composed that did not differ significantly from that composed according to induced mutations. Possible mechanism of the action of mutation xrs_1 is discussed on the basis of the data obtained. (auth)

27839 CONDITIONAL LETHAL RADIATION-SENSITIVE MUTANTS OF YEAST. III. The Repair of Spontaneous and X-Rays Induced Lethal Lesions Under Non-Growth Conditions. Bandas, E. L. (Inst. of Nuclear Physics, Leningrad). Genetika; 9: No. 2, 127-135(Feb 1973). (In Russian).

The diploid conditional lethal radiation-sensitive mutant strains and the strain of the wild type Saccharomyces paradoxus were found to repair the x-ray-induced lethal lesions of water agar medium at 26° (permissive) and 37° (restrictive temperature). The mutants 1, 5, and particularly the strain 2 have shown an appearance of spontaneous lethal lesions that prevent the unlimited division of intact cells in normal growth conditions. The mutant 2 can repair such spontaneous lethal lesions on water agar medium. (auth)

27840 GENETIC ANALYSIS OF MULTIPLE PHENOTYPIC VARIATIONS IN THE MUTANT OF SALMONELLA TYPHIMURIUM LT2 OBTAINED BY A SINGLE TREATMENT WITH NITROSOGUANIDINE. Skavronskaya, A. G.; Pokrovskii, V. N. (Inst. of Epidemiology and Microbiology, Moscow). Genetika; 9: No. 2, 170-172(Feb 1973). (In Russian).

Genetic characteristics of a mutant of Salmonella typhimurium LT2 obtained by nitrosoguanidine was investigated. The mutant acquired a number of phenotypic variations (sensitivity to uv-light and temperature, resistance to streptomycin, dependence on isoleucine). Phenotypic properties of the mutant were due to four mutations located at different regions of the chromosome. The mutation provoking uv sensitivity was related to the gene; probably, uvr A linked with the mal B marker (1.8% of contransduction). The mutation to streptomycin resistance was located in the str A gene (2.8% of contransduction with the gene cys G). Mutation in ile gene and mutations in uvr A and str A genes were leading to variations of the particular property only (in this case, the dependence on isoleucine). Sensitivity of the mutant to temperatures was not due to mutations linked to the aforementioned genes mutated in strain P 15. The results obtained demonstrated the emergence of a number of mutations in different genes of one genome during a single treatment of bacteria with nitrosoguanidine. (auth)

27841 IRRADIATED FOOD. Diehl, J. F. (Federal Research Center for Food Preservation, Karlsruhe, Ger.). Science; 180: No. 4082, 214-215(13 Apr 1973).

The toxicological safety of irradiated fish is considered. Radiolysis products in irradiated food are discussed. (MCG)

27842 USE OF IONIZING RADIATIONS TO INHIBIT THE SPROUTING OF POTATOES. I. Tests on the Prolongation of Shelflife and the Quality of Bintje-Potatoes. Baraldi, D.; Guerrieri, G.; Miuccio, C. (CNEN, Casaccia, Italy). Ind. Conserve; 46: No. 4, 269-276(1971). (In Italian). (RT/BIO-72-56).

In order to compare the effect of preservation by chemical agents with that by irradiation, two sample groups of Bintje-potatoes were irradiated with doses of 8.5 and 10 krad respectively by using a ^{60}Co source; a third sample group was treated with 10 mg/kg of IPC/CIPC. The different sample groups were kept in a storage cell at 10°C and 85 to 90% relative humidity. During 10 months of storage, physical, chemical, and technological determinations were carried out. The results show that by irradiation the sprouting is completely inhibited and the potatoes are preserved in good conditions for a longer time than the chemically treated sample group. (auth)

27843 T_4-MEDIATED v-GENE REACTIVATION OF UV-IRRADIATED PHAGE TI, AND ITS COMPARISON WITH HOST-CELL REACTIVATION. Harm, W. (Univ. of Texas, Dallas). Mutat. Res.; 17: No. 2, 163-176(Feb 1973).

Uv-irradiated (254 nm) phage TI undergo host-cell reactivation (HCR) after infection of Escherichia coli cells possessing an intact excision–resynthesis repair system. Results show that TI can also be reactivated in host-cell reactivation defective (HCR^-) bacteria (E. coli B_{S-1}, or K12 strains carrying a uvrA or uvrC mutation), if these are superinfected with heavily uv-irradiated phage T4. This effect, which reflects an average repair of 70% of the TI lethal lesions, requires the v gene function of T4. It is not observed when the mutant $T4v_1$ is used for superinfection, and is therefore called v-gene reactivation (vR) of TI. Comparison of HCR and vR shows that maximal HCR of TI is usually observed in only a minor fraction of the host-cell population, while maximal vR of TI occurs in most, if not all, of the vR-proficient complexes. Caffeine at a permanent concentration of 2 mg/ml, or acriflavine at 3 μg/ml, inhibits HCR completely but affects vR of TI little or not at all. Preirradiation of the host cells inhibits HCR considerably more than vR of TI, and does not affect vR of T4. vR occurs also in HCR^+ host cells, where it increases the TI survival only slightly. Presumably the bacterial uv endonuclease involved in HCR, and lacking in HCR^- cells, can be replaced by the T4 uv endonuclease to permit excision repair in TI, but it seems likely that the enzymes engaged in later repair steps are of bacterial rather than T4 origin. (auth)

27844 LON-CULTURES OF S. TYPHIMURIUM. Levashev, V. S.; Abramova, M. A. (Moscow Medical Inst.). Zh. Mikrobiol., Epidemiol. Immunobiol.; 49: 66-71(Oct 1972). (In Russian).

A study was made of ultraviolet sensitivity of LT_2, LT_1, and LT_2WT S. typhimurium cultures. LT_2 and LT_1 cultures proved to be sensitive to ultraviolet irradiation, and LT_2WT-resistant. The curve of ultraviolet sensitivity of the LT_2 culture was characteristic of lon-cultures. Sensitivity of the cultures was not associated with the changes in the system of dark repair, of the system of recombination and formation of nonviable filaments. The filaments that formed after the ultraviolet irradiation were viable and possessed the capacity to reproduction. Mutants of LT_2 culture, spontaneously forming viable filamentous forms, were obtained. On the basis of ultraviolet sensitivity and the capacity to form filamentous forms the LT_2, LT_1 S. typhimurium cultures under study could be referred to lon-cultures. (auth)

27845 STUDIES ON THE METHODS FOR IDENTIFICATION OF GAMMA-IRRADIATED POTATOES. Matano, K.; Eto, T.; Nakamura, T. (National Inst. of Health, Tokyo). Proc. Jap. Conf. Radioisotop.; No. 10, 414-416(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

The measurement of enzyme activity cannot be a desirable method for distinguishing irradiated potatoes from non-irradiated ones because the activity varies much more among individuals, although the activity is affected by irradiation by gamma rays. In the case of low dose for sprout inhibition, the formation of new ingredients and the disappearance of any ingredient do not occur, although a numerical difference is seen between the irradiated potatoes and the unirradiated ones in storage of up to three months after the irradiation. This numerical value is not an effective method for distinction, unless the difference of value is extremely large. The difference of value is not seen after three months following irradiation. Histological and cytological methods seem to be more effective so long as the mechanism of the sprout prohibition by gamma irradiation is not an extension of dormancy but a destruction of sprout cells. (Japan)

27846 RADIATION PRESERVATION OF FOODSTUFFS. Wegener, H. Arch. Lebensmittelhyg.; 23: No. 5, 109-110(May 1972). (In German).

The possibilities of using high-energy electrons, x rays, and γ rays in the preservation of edible ocean fish, and other foodstuffs, and the health-associated criteria are briefly discussed. A number of countries of the world have approved ionizing radiation for limited application, such as the inhibiting of the sprouting of potatoes. The efforts of the chief health agencies of the world to secure and disseminate valid information on possible toxic effects of radiation-preserved foodstuffs are summarized. (KSW).

27847 IRRADIATION OF COCOA POWDER. Gruenewald, T.; Muenzner, R. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Lebensm.-Wiss. Technol.; 5: No. 6, 203-206(1972). (In German).

Cocoa powder is relatively sensitive to ionizing radiation with regard to flavor changes, the sensitivity increasing with the content of fat in the cocoa powder. The dose of 500 krad required for the aimed reduction of the number of viable organisms, is only acceptable if the irradiation is performed under vacuum or in an inert atmosphere or if the powder is further treated according to special recipes. The high content of long-lived free radicals in non-irradiated cocoa powder is increased by irradiation and even after storage for some weeks this value is still higher than that of the unirradiated control. (auth)

27848 GAMMA-IRRADIATION OF MUSHROOMS AND ITS EFFECT ON ACTIVE AND LATENT FORMS OF O-DIPHENOL OXIDASE. Yamaguchi, M.; Campbell, J. D. (Univ. of Manitoba, Winnipeg). Radiat. Bot.; 13: No. 1, 55-58(Feb 1973).

Gamma-irradiated mushrooms held for 3 and 6 days at 10°C were evaluated for appearance and quality and for changes in active and latent (inactive) forms of o-diphenol oxidase (o-DPO). The appearance of samples treated with 50, 100, 200, and 300 krads were notably better than the controls after 3 days in storage. After 6 days, samples treated with dosages of 100 krads and higher were in fair condition, the 50 krads samples were poor to fair, and the controls were unsalable. The stalks of the fruiting body contained more active and latent forms of o-DPO than the caps. No significant change was noted in these forms immediately after irradiation. In all treatments the active form increased with storage time while the latent form increased slightly after 3 days then decreased after 6 days of storage. (auth)

27849 RADIOSENSITIZATION OF ANOXIC CELLS BY METRONIDAZOLE. Foster, J. L.; Willson, R. L. (Mount Vernon Hospital, Northwood, Eng.). Brit. J. Radiol.; 46: No. 543, 234-235(Mar 1973).

A study was made of the sensitization properties of metronidazole using gamma irradiated Serratia marcescens and the root of Vicia faba. With Serratia, sensitization occurred in anoxic, but not oxic conditions; the enhancement ratio (ER), increased with increasing drug concentration (ER = 1.2 ± 0.1 with 250 μM metronidazole to an ER = 1.8 ± 0.2 with 10 mM). The viability of unirradiated bacteria was not affected by suspension in 10 mM metronidazole for 1 hr. Results with bean roots and 10 mM solutions of the drug showed an enhancement ratio of 1.6 under anoxic conditions. This maximum degree of sensitization was also obtained with 6 mM after only 10 min preirradiation treatment, indicating ready diffusion through the cellular material. No sensitization was detected under aerated conditions and post-irradiation treatment of roots in aerated or anoxic conditions had no effect. The effect could be removed by washing treated roots in water. Immersion of roots containing active cells in 50 mM solutions for 1 hr did not affect the growth rate and the ER for this system was 2.7. (UK)

27850 DETERMINING THE SENSITIVITY OF MICROORGANISMS TO RADIATION. Kiss, I. Elelmiszervizsgalati Kozlem.; 17: No. 5-6, 237-246(1971).

Survival data of microorganisms must be determined at a relatively great number of exposures with particular respect to those below 0.1 Mrad and over 0.5 Mrad. It is advisable to inoculate within 24 hr after irradiation. Accurate determination of low germ counts demands the application of the membrane filter method and the minimum germ counts causing deterioration in the smallest and the largest unit packages of foods must be established. The test results must comprise the equilibrium relative humidity, water activity, and pH value of the substrate or suspending medium containing the microorganism to be tested, and the age of the culture or microbe suspension. The number of test data must be sufficient to attain the limit of statistical evaluation. (Hung. Tech. Abstr.)

27851 RADIATION PASTEURIZATION OF MEDIUM FATTY FISH. I. Control of Radiation Induced Oxidative Changes in White Pomfret (Stromateus Cinereus) by Vacuum Packaging.

Kamat, S. V.; Kumta, U. S. (Bhabha Atomic Research Centre, Bombay). Fish. Technol.; 9: No. 1, 8-16(1972).

White pomfret was examined for its response to irradiation treatment. Skin and muscle tissues of the fish analyzed separately showed greater concentrations of triglycerides, free fatty acids, and phospholipids in former than in latter. Assessment of the fish tissue samples in terms of peroxide, carbonyl, free fatty acids (FFA) and 2-thiobarbituric acid (TBA) values, indicated that the skin was more susceptible to radioinduced oxidative changes than the muscle. Development of rancid odors (0.5 Mrad and higher doses of radiation) and yellow discoloration (1.5 Mrad) were noted in the irradiated skin as against burnt type of odors in muscle. Prepacking under vacuum effectively suppressed the oxidative changes and associated undesirable alterations in color and odor of the skin tissue on irradiation as well as during storage at 0 to 2°C. (Indian Sci. Abstr.)

27852 ADVANCES IN STERILIZATION TECHNIQUES: STATE OF THE ART AND RECENT BREAKTHROUGHS. Boucher, M. G. (Wave Energy Systems, Inc., New York). Amer. J. Hosp. Pharm.; 29: 661-672(Aug 1972).

The technology of sterilization with its numerous applications in the hospital, pharmaceutical, food processing, and environmental fields is reviewed. (MCG)

27853 STUDIES ON THE IDENTIFICATION OF IRRADIATED POTATOES. Part 2. Determination of Chlorogenic Acid. Penner, H.; Fromm, H. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Z. Lebensm.-Untersuch. Forsch.; 150: No. 2, 84-87(1972). (In German).

A quantitative method for the direct determination of chlorogenic acid on thin-layer plates by use of a programmable calculator is described. The content of chlorogenic acid in irradiated potatoes immediately rises after irradiation and returns to normal within several weeks. The identification of irradiated potatoes was only possible within a few days after irradiation and only in comparison with non-irradiated potatoes of the same lot. (GF)

27854 RADIATION PASTEURIZATION OF MEDIUM FATTY FISH. III. Storage Properties of White Pomfret (Stromateus Cinereus) Fillets. Kamat, S. V.; Gaonkar, S. G.; Kumta, U. S. (Bhabha Atomic Research Centre, Bombay). Fish. Technol.; 9: No. 1, 25-30(1972).

A radiation pasteurization process integrating low-dose irradiation with vacuum packaging is described for white pomfret, based on suppression of oxidative changes in the fish stored at 0 to 2°C. Organoleptic, chemical, and bacteriological analysis indicated that the unirradiated fish fillets packed under aerobic or anaerobic conditions and stored at 0 to 2°C, spoiled within 8 and 12 days respectively. Dose dependent extension in shelf-life was, however, exhibited by the irradiated fish. Anaerobically packed fish fillets exposed to radiation doses of 0.1, 0.3, and 0.5 Mrad showed extended shelf-life of 35, 50, and 60 days respectively without undergoing any loss in quality attributes of color, odor, or texture. The fish samples packed under aerobic condition were, however, prone to development of rancid odors on irradiation (0.5 Mrad) and yellow discoloration (0.3 and 0.5 Mrad) during storage and also exhibited lesser extension in shelf-life when compared to anaerobically packed fish. (Indian Sci. Abstr.)

27855 RADIATION PASTEURIZATION OF MEDIUM FATTY FISH. II. Precursors of Yellow Discoloration in Irradiated White Pomfret (Stromateus Cinereus). Kumta, U. S.; Kamat, S. V. (Bhabha Atomic Research Centre, Bombay). Fish. Technol.; 9: No. 1, 17-24(1972).

Among the major chemical constituents of white pomfret examined, the triglycerides isolated from skin and muscle tissues, phospholipids from skin, and sarcoplasmic proteins of the muscle contributed appreciably toward 2-thiobarbituric acid reactive substances (TBRS) on irradiation. Contribution by the other constituents of the fish was comparatively less. In vitro reaction under aseptic condition of the skin tissue with pure malonaldehyde produced yellow coloration of the former. Comparison of the spectral characteristics of yellow color formed by this in vitro reaction with those of the colors formed in situ in irradiated skin samples, suggested that the three pigments were similar in nature. (Indian Sci. Abstr.)

Radiation Effects on Plants

Refer also to abstracts 27849, 27853, and 27929.

27856 (AEC-tr-7415, pp 1-12) MOLECULAR MECHANISMS OF THE STIMULATING EFFECT OF IONIZING RADIATIONS ON PLANT SEEDS. Kuzin, A. M. (Inst. of Biol[illegible]al Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 635-643(1972).

The possible molecular mechanisms of the stimulating action of γ irradiation of seeds at optimum doses on the growth and development of plants are discussed. On the basis of experiments and an analysis of the literature data, a hypothesis is suggested, according to which a leading place in the stimulation is set aside for trigger effectors, which induce a transition from one phase of development to the following phase, and the possible mechanisms of the increase in the level of such nonspecific and specific trigger effectors under the influence of irradiation are followed. (tr-auth)

27857 (AEC-tr-7415, pp 57-64) UPTAKE, METABOLISM, AND RADIOPROTECTIVE EFFECT OF CYSTEAMINE IN THE CASE OF IRRADIATION OF MERISTEMATIC TISSUES AND A CULTURE OF ISOLATED PLANT CELLS. Grodzinskii, D. M.; Gudkov, I. N.; Viktorova, N. V.; Avakyan, L. M. (Inst. of Plant Physiology, Kiev). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 676-680(1972).

In pea seedlings, the maximum radioprotective effect is manifested in the case of exposure for 3 hrs to a nutrient medium containing cysteamine in a concentration of 10^{-3} M; in a suspension culture of tobacco cells, a stay of the cells in the medium with the protector for 6 min proved sufficient for manifestation of the maximum protective effect. The accumulation of ^{35}S-cysteamine in the meristem of seedlings occurs considerably more slowly than in cells of a culture. The bulk of the activity for both objects is detected among the sulfur-containing amino acids, proteins, and soluble sulfates. (tr-auth)

27858 (AEC-tr-7415, pp 91-98) INFLUENCE OF SECONDARY RADIATION FROM 70-GeV PROTONS ON THE NUMBER OF ABERRANT CELLS IN BROAD BEAN ROOTS. Akoev, I. G.; Fomenko, B. S.; Akhmadieva, A. Kh.; Lebedev, V. N.; Lukanin, V. S. (Inst. of Biological Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 701-707(1972).

Broad bean seeds were irradiated with the secondary radiation generated by 70 GeV protons and by the γ radiation of ^{137}Cs. The secondary radiation included mesons of different signs and charges, neutrons, protons, γ quanta, and others with a broad energy spectrum. According to the number of aberrant anaphases (with bridges and fragments) in the first mitosis, the radiation of the accelerator was 50 to 90% more effective than γ radiation. For both types of radiation, the nature of the dose curves depends on the period of fixation, while the ratio of the slopes of the dose curves of the rate of decrease in the number of aberrant cells with time during the first mitosis in the case of irradiation of seeds on an accelerator and by γ radiation is 1.7. (tr-auth)

27859 (AEC-tr-7415, pp 155-158) STUDY OF THE REMOTE INFLUENCE OF RADIATION ON THE CONTENT OF DIHYDROXYPHENOLS IN COTTON LEAVES BY GRAFTING. Nazirov, N. N.; Sadykov, A. S. (Inst. of Experimental Biology, Tashkent). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 753-755(1972).

A small, statistically significant increase in the amount of dihydroxyphenols in leaves of irradiated plants was detected in comparison with nonirradiated plants. When a nonirradiated plant was grafted onto an irradiated plant, the amount of dihydroxyphenols in the leaves of the scion was significantly increased, while in the rootstock it was reduced in comparison with an ungrafted irradiated plant and with its self-grafts. In the reverse combination, in the irradiated scion their content was lower than in the self-grafted and ungrafted irradiated plants. Moreover, the amount of these compounds was somewhat increased in the non-irradiated rootstock. (tr-auth)

27860 RELATIVE BIOLOGICAL EFFECTIVENESS OF HEAVY PARTICLES FROM THE REACTION $^{10}B(n,\alpha)^7Li$ FOR CYTOGENETIC EFFECTS IN A PLOIDY SERIES OF THE GENUS TRITICUM. Ikushima, T. (Kyoto Univ., Osaka). Jap. J. Genet.; No. 47, 401-410(Dec 1972).

Seeds of T. monococcum (2X), T. durum (4X) and T. aestivum (6X), with and without enrichment of ^{10}B were exposed to thermal neutrons or x rays. The RBE values of heavy particles from $^{10}B(n,\alpha)^7Li$ reaction compared with x rays were determined at each ploidy level for reductions in seedling height and seed setting in the M_1 generation and also with respect to induction of chlorophyll mutations in the M_2 generation. The RBEs reported here are generally lower than those reported earlier for the use of re-dried seeds. Although no definite relationship was found between RBE values and ploidy levels, thermal neutrons were very effective in ^{10}B-enriched seeds with respect to induction of chlorophyll mutations even in the hexaploids. There was a positive relation between the occurrence of the M_1 spike mutations and of chlorophyll or spike mutations among their progenies, especially in thermal neutron treatments of ^{10}B-enriched seeds. The relative biological ef-

fectiveness and the tolerance of the polyploids were discussed and compared with other results reported in the literature. (auth)

27861 SOMATIC MUTATION RATE IN TRADESCANTIA STAMEN HAIRS AT LOW RADIATION LEVELS: FINDING OF LOW DOUBLING DOSES OF MUTATIONS. Ichikawa, S. (Kyoto Univ.). Jap. J. Genet.; No. 47, 411-421(Dec 1972).

Somatic mutation rates from blue to pink were studied in the stamen hairs of Tradescantia ohiensis KU 7 clone, a blue/pink heterozygote, exposed to 100 to 510 mR/hr gamma rays or to 12 mR/hr scattering radiation. The results obtained supported the previous finding of the sensitive genetic responses of this botanical system, demonstrating that the genetic effect could be detected with this system at a radiation level as low as 3.60 R total exposure (also possibly only 0.96 R) given at a low exposure rate of 12 mR/hr. Pooling the present and previous data, a somatic mutation rate of 3.88 or 3.43×10^{-4} pink mutant events per hair per R was obtained for gamma irradiation during hair development. The somatic mutation rate calculated for scattering radiation was even higher than this (1.25×10^{-3}). The doubling dose of the somatic mutations at the specific locus was calculated to be 13.8 or 15.6 R when irradiated with gamma rays during hair development, and the corresponding value with scattering radiation was 4.29 R. Lower doubling doses could be calculated based on published data from the stamen hairs of the same and three other Tradescantia clones irradiated more acutely. These low doubling doses seem to throw doubt on the safety standards of radiations. (auth)

27862 CAFFEINE POTENTIATION OF THE CHROMOSOME DAMAGE PRODUCED IN BEAN ROOT TIPS AND IN CHINESE HAMSTER CELLS BY VARIOUS CHEMICAL AND PHYSICAL AGENTS. Kihlman, B. A.; Sturelid, S.; Hartley-Asp, B.; Nilsson, K. (Royal Agricultural Coll. of Sweden, Uppsala). Mutat. Res.; 17: No. 2, 271-275(Feb 1973).

Root tips of the broad bean, Vicia faba, were treated with mitomycin C, TEPA, bis A, mono A, thio TEPA, maleic hydrazide, and 4-NQO. Post-treatment with caffeine strongly increased the frequencies of chromosomal aberrations induced by these agents. The aberration frequency induced by x rays was not markedly influenced by post-treatment with caffeine. In Chinese hamster cells the frequencies of chromosomal aberrations produced by uv radiation, mitomycin C, thio TEPA, and 4-NQO were strongly increased by caffeine post-treatments, whereas the aberration frequency produced by x rays was not affected. (HLW)

27863 MUTABILITY OF TOMATO IN GAMMA-FIELD. Kvasnikov, B. V.; Dolgikh, S. T.; Khafizov, R. N. (Research Inst. of Vegetable Crops, Moscow). Genetika; 9: No. 2, 9-13(Feb 1973). (In Russian).

The mutability of tomato was studied under gamma irradiation at different stages of ontogeny. The highest frequency of radio-induced mutations was observed at the dose of 5 R/hr (total irradiation dose 900 R) at the stage of 2 to 3 real leaves and during the whole vegetative period (total irradiation dose 6.40 kR). At the dose rate of 2 R/hr (total irradiation dose 400 R), the highest frequency of mutations was observed at stages of bud, blooming, and fruit ripening. The specificity of the origin of separate mutation forms is demonstrated according to the effect of radiation at certain stages of ontogeny. (auth)

27864 MUTABILITY OF HARICOT INDUCED BY GAMMA IRRADIATION AND TREATMENT WITH ETHYLENIMINE AND ITS DERIVATIVES (SEPARATE AND COMBINED EFFECTS). Rukmanski, G. Ya. (Agricultural Academy, Sofia). Genetika; 9: No. 2, 14-20(Feb 1973). (In Russian).

Effect of different doses of gamma irradiation (4.6 and 8 kR) and chemical mutagens—ethylenimine (EI) (0.002%; 0.006%; and 0.01%), diethyl ester of β-ethyleneiminethylphosphine acid (K-16) (0.02%; 0.06%; and 0.1%), and diethyl ester of β-(β′,β′-dichlorodiethylamino) ethylphosphine acid (K-32) (0.0006%; 0.0012% and 0.0018%) on haricot variety Processor was studied. Combined effect of gamma irradiation (6 kR) and EI (0.006%), K-16 (0.06%) and K-32 (0.0006%) was also investigated. The data obtained showed that the highest frequency of mutability was observed under effect of ethylenimine (0.01%), then followed gamma-irradiation (8 kR). Other doses and concentrations of mutagens produced considerably less mutation effect. Gamma-irradiation (8 kR) produced more types of mutational changes than EI (0.01%). Combined treatment of haricot with gamma irradiation (6 kR) and EI (0.006%), K-16 (0.06%), and K-32 (0.0006%) resulted in decreased hereditary variability as compared with separate administration of every mutagen. The main amount of the mutant types observed was represented with late-ripening, sterile, and half-sterile forms. Nevertheless, the forms with useful industrial characters (early-ripening, large-tiller forms) were found among the mutants. (auth)

27865 EFFECT OF POST-IRRADIATION TREATMENT WITH IAA ON FREQUENCY OF CHROMOSOME ABERRATIONS IN GERMINATING CREPIS CAPILLARIS SEEDS AT DIFFERENT TEMPERATURES. Yurgelaitite, K. N. V.; Slavenas, I. Yu.; Nemtseva, L. S. (Inst. of General Genetics, Moscow). Genetika; 9: No. 2, 29-34(Feb 1973). (In Russian).

Soaked Crepis capillaris seeds were gamma-irradiated. After irradiation they were treated with indole-β-acetic acid (IAA). The latter was shown to affect the frequency of gamma-irradiation induced chromosome aberrations. At low temperatures the IAA treatment significantly increased the chromosome aberration frequency. (auth)

27866 SENSITIZING EFFECT OF 5-BROMODEOXYURIDINE OF GAMMA-IRRADIATED CREPIS CAPILLARIS CELLS AT POST-SYNTHETIC PERIOD OF THE CELL CYCLE. Tarasov, V. A.; Safonova, G. M. (Inst. of General Genetics; Moscow). Genetika; 9: No. 2, 35-44(Feb 1973). (In Russian).

The sensitizing effect of 5-bromodeoxyuridine (BUdR) on its incorporation in chromosome DNA at G_1-phase, S-, and G_2-phases or at G_2-phase only of the first cycle after the beginning of germination was studied in meristem cells of Crepis capillaris seedlings. Metaphase cells irradiated at the G_2-phase of the cell cycle were investigated. Treatment of cells with thymidine during the G_2-phase of the first cell cycle in the cells, which incorporated BUdR at the point of replication, eliminated the sensitizing effect of thymidine under gamma-irradiation of the cells at the G_2-phase of the second cell cycle. If the cells were treated with BUdR at the G_2-phase of the first mitotic cycle (independently of BUdR treatment during the S-phase of the first mitotic cycle) and incorporated BUdR into those sites of DNA in which spontaneous additional synthesis took place, sensitizing effect of BUdR was observed under gamma irradiation of the cells at the G_2-phase of the second cell cycle. (auth)

27867 INDUCED LIGULELESS MUTATION IN DURUM WHEAT. Bagnara, D.; Rossi, L.; Ligato, L. (CNEN, Casaccia, Italy). Genet. Agr.; 26: No. 3-4, 278-290(21 Dec 1972).

Data are reported, concerning morphological and agronomic features and pattern of inheritance of a mutation independently isolated, in Triticum durum, in 3 M_2 progenies from the line Ga B 125 and in 1 M_2 progeny from the cultivar Capeiti. Treatments with fast and thermal neutrons and ethylmethane sulphonate were previously applied to dry caryopses. As a consequence of the mutation, ligula is strongly reduced and auricolae disappear: the resulting phenotype is called liguleless and is represented, although in very limited areas, in the natural variability not only of T. durum, but also of T. aestivum, T. compactum, and other cereals. It was, however, never induced as a mutation in T. durum. Leaves in the mutated plants are much more erect than in the non-mutated. The possible implications from the point of view of the inner-plant competition in the light utilization are obvious. Segregation data were available from the following generations: M_2, M_3, and sometimes M_4; F_2 from the backcrosses to mother lines and from crosses to other durum lines; and F_1 and F_2 from diallel crosses among the several mutant lines. They all indicate that the mutation is monofactorial and incompletely recessive and that the locus involved is the same, both in Ga B 125 and in Capeiti. In each of the mutant lines, besides the liguleless mutation, side effects are visible on other characters, sometimes advantageous, some others deleterious from the agronomic point of view; such characters are: heading time, plant height, number of culms, number and fertility of spikelets, and kernel weight. Finally, a discussion is made on the eventual utilization of liguleless mutation in plant breeding, either directly or by means of transfer to other genotypes. (auth)

27868 MANIPULATION OF CROSSING OVER WITH INTRINSIC AND EXTRINSIC FACTORS. Mock, J. J. (Iowa State Univ., Ames). Egypt. J. Genet. Cytol.; 2: No. 1, 158-175(Jan 1973).

A literature review is presented of mechanisms for enhancing and depressing chiasma frequency and recombination of genes. Intrinsic factors discussed are chromosome rearrangements, genetic recombination, inversions, and selection. Extrinsic factors discussed are temperature, gamma radiation, x radiation, and chemicals. A discussion is given of applications to plant breeding. (HLW)

27869 EFFECT OF IRRADIATION DOSE RATE ON THE DEVELOPMENT OF CROWN GALL TISSUE COLONIES IN SCORZONERA IRRADIATED WITH ^{60}Co γ RAYS. Jonard, R.; Bayonove, J. (Univ., Montpellier, France). Compt. Rend., Ser. D; 275: No. 22, 2489-2492(27 Nov 1972). (In French).

The use of very low dose rates (less than 1 rad/mm) combined with recovery techniques resulted in an appreciable reduction in the lethality of very large doses of γ irradiation. (France)

27870 DEVELOPMENTAL GENETIC STUDIES ON SOME QUANTITATIVE CHARACTERS OF RICE, ORYZA SAVITA L. I. Variation and Correlation in Length of Different Organs of Rice. Balal, M. S. (Ministry of Agriculture, Giza, Egypt). Egypt. J. Genet. Cytol.; 1: No. 1, 85-91(Dec 1971).

Investigations with a number of lines randomly derived from the Norin No. 8 variety of rice indicated that genetic variability was present in lengths of panicle, leaves and culm internodes in the original variety. It was also found that an x-ray treatment increased genetic variability of those characters. Studies on genetic correlation led the writer to conclude that vegetative organs of rice plants can be divided into more than two developmental groups; the upper and the basal in addition to a few independent organs. (auth)

27871 DEVELOPMENTAL GENETIC STUDIES ON SOME QUANTITATIVE CHARACTERS OF RICE, ORYZA SATIVA L. II. Degree of Pleiotropic Action of Polygenes Among Different Organs of Rice. Balal, M. S. (Ministry of Agriculture, Giza, Egypt). Egypt. J. Genet. Cytol.; 1: No. 2, 149-156(Jun 1972).

The degree of pleiotropic action of quantitative genes responsible for formation of leaves, panicle, and culm internodes of x-irradiated and control lines of rice was investigated. It was found that "upper organs" are highly related to each other and the same also holds for the "basal organs," but the upper organs and the basal organs are less interrelated. It was suggested that, beside genes controlling general or basic growth, there are specific genes or groups of genes each of which is responsible for quantitative variation in development of a specific organ or a group of organs. (auth)

27872 INFLUENCE OF POST-IRRADIATION TREATMENT WITH SOME CHEMICALS ON THE RECOVERY OF CHROMOSOMAL ABERRATIONS IN BARLEY (HORDEUM VULGARE). Kaul, K. L.; Kak, S. N. (Regional Research Lab., Jammu, India). Egypt. J. Genet. Cytol.; 2: No. 1, 76-83(Jan 1973).

Seeds of barley were irradiated with 15, 20, and 40 kR of gamma rays and were post-treated with different chemicals as ATP, auxins like gibberellic acid, indole-3 butyric acid, alkylating-mutagen, ethylmethane sulfonate, propane sultone, an inhibitor of DNA synthesis, hydroxyurea, and cycloheximide, a protein synthesis inhibitor. The object of the study was to investigate the influence of these chemicals on the recovery of chromosomal aberrations. The data presented show that while ATP, GA and IBA enhance the process of recovery, the rest of the chemicals such as EMS, PS, HU cycloheximide, have the opposite effect. It has been suggested that a regulated and normal synthesis of both DNA and proteins which form the essential constituents of the structural organization of the chromosome is very essential for the process of post-irradiation recovery. (auth)

27873 EFFECTS OF X-RAYS ON THE RESPONSE TO SELECTION FOR EAR LENGTH AND PLANT HEIGHT IN ZEA MAYS. Mourad, A. M.; Tantawy, A. O.; El-Metainy, A. (Univ. of Alexandria, Egypt). Egypt. J. Genet. Cytol.; 1: No. 1, 28-40 (Jan 1972).

Effects of x rays on the means, variances and the response to selection of some quantitative characters in maize were investigated. The F_1 plants from x-ray treated inbred parents as well as from untreated single crosses exhibited increases in all the characters over the controls. The response to selection and the realized heritability in the case of the characters subjected to selection varied with the x-ray doses. The highest values were obtained from the treatments with 5000 R. The response to selection of plant height was asymmetrical while that of ear length was symmetrical. X-irradiation with suitable doses was found to be an efficient agent capable of inducing significant amounts of polygenetic variability that could be utilized by selection in inbred maize populations. (auth)

27874 EFFECT OF SEED γ IRRADIATION ON SIDA CHROMOSOME APPARATUS. Dmitrashko, P. I. (Odessa State Univ.). Tsitol. Genet.; 6: No. 5, 431-433(1972). (In Russian).

In cells of sprout rootlets, irradiation causes various mitosis disturbances in a form of fragments, delayed chromosomes, and chromosome bridges. With an increase in the seed irradiation dose, a number of the disturbance grows. A dose of 100 kR decreases the seed germination energy, causes anomalies in the sprout form, and many sprouts die. (auth)

27875 MUTAGENESIS IN DURUM WHEAT: ISOLATING AND AGRONOMIC TRAITS OF SHORT STRAW MUTANTS IN CAPEITI VARIETY. Rossi, L.; Bagnara, D. (CNEN, Casaccia, Italy) Genet. Agr.; 26: No. 3-4, 305-320(31 Dec 1972). (In Italian).

Data are reported from an experiment of mutagenesis in Triticum durum cv. Capeiti, concerning the M_3 generation of 788 short straw mutants isolated in M_2, along with agronomic features of some of them after two years of preliminary agronomic trials. About 95% of M_3 progenies confirmed to have a shorter culm than the mother line. In some of them, the reduction is about 60%. Within a great deal of M_3 progenies, there is still a segregation for culm length. In general, the stronger the culm reduction, the higher the heterogeneity. Short straw mutants show a series of other modifications, involving chlorophyll apparatus, plantlet morphology, shape, size and color of spikes and kernels, and very frequent cases of sterility. Again, the stronger the culm reduction, the higher the frequency of these modifications. Agronomic characters such as heading time, tillering, kernel size, and kernel weight in the main spike, are also affected in the mutated progenies. Several possible mechanisms of culm reduction are briefly listed. The genetic basis of short straw mutations seems to be extremely aspecific. In fact, a high number of factors, besides several chromosomic aberrations, seems to be able to induce, at several ontogenetic levels, a reduction in plant vitality and culm length. (auth)

27876 MUTAGENESIS IN DURUM WHEAT: ISOLATING AND AGRONOMIC TRAITS OF EARLY MUTANTS IN CAPEITI VARIETY. Rossi, L. (CNEN, Casaccia, Italy). Genet. Agr.; 26: No. 3-4, 290-304(31 Dec 1972). (In Italian).

Data are reported concerning mutants for earliness considered in M_3 generation from an experiment of mutagenesis in Triticum durum cv. Capeiti. In respect to the isolation in M_2, a very high percentage of mutants turn out to confirm the mutation in M_3, considering both the average progeny heading time and the earlier plant in the progeny. In earlier progenies, other modifications are visible, concerning chlorophyll apparatus, spikes, caryopses, vegetative habit, and fertility. Generally, the earlier the mutants, the higher the frequency of modifications, this being particularly true for sterility. Similarly, some agronomic characters, as height, tillering, and weight of caryopses from the main spike, were also affected, usually in the sense of a lesser viability. However, some very early mutants (one week in respect to control) do not show any deleterious effect in this respect. The genetic basis of the induced mutations seems to be a rather simple one; some of them behave as complete or partial dominant. As far as the induction of earliness is concerned, the higher effectiveness of fast neutrons in respect to thermal neutrons and ethylmethanesulfonate, previously pointed out in other experiments, is again confirmed. (auth)

27877 EFFECTS OF ACUTE X-IRRADIATION UPON GROWTH OF PARTHENOCISSUS TRICUSPIDATA AXILLARY BUDS. Langenauer, H. D. Amherst, MA; Univ. of Massachusetts (1972). 130p. University Microfilms Order No. 73-6691.

Thesis (Ph. D.).

Parthenocissus tricuspidata axillary buds were exposed to 600 R of acute soft x rays at 0, 2, 4, 6, or 8 days following release from apical inhibition. Radiation responses of buds irradiated at different developmental stages were studied morphologically in shoots grown from exposed buds. Anatomical sections of controls were compared with those of specimens harvested at various intervals following irradiation. Based on radiation response the buds were divided into two populations. Younger buds, irradiated within two days after release from apical inhibitions behaved similarly, and older buds, experiencing 4- to 8-day delays, could be classified together. Younger-treated buds showed more severe growth inhibition than did older-treated ones. Radiation damage in buds was manifested in the abnormalities which appeared as they developed into shoots. Buds which were more developed at the time of irradiation produced more tissue before radiation-induced abnormalities were manifested, while younger-treated buds produced little shoot growth before a radiation-induced anomaly was revealed. (CH)

27878 RECENT DEVELOPMENT OF RADIATION-INDUCED MUTATION BREEDING IN JAPAN. Yamaguchi, H. (Tokyo Univ.). Proc. Jap. Conf. Radioisotop.; No. 10, 556-561(Apr 1972).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

In Japan, radioinduced mutation breeding was recently successfully applied to various crops, and proved to be a useful method. The acreage of a rice variety Reimei developed by this method reached to 141,000 ha in 1969. Recently, two new varieties, Zenkouji-Komugi of wheat and Amagi 2-jo No. 1 of barley, were released commercially in 1969 and 1970, respectively. A summary is presented of recent developments in radioinduced mutation breeding. The yield of free ribosomes increased at the expense of bound ribosomes in γ-irradiated barley seedlings. Mutagen-induced sterility may be caused by genetic and physiological effects. Heritable sterility observed after ethylenimine or x-ray treatment of rice seeds can be classified into gametic and zygotic sterility. The radiosensitive periods in the irradia-

tion of growing plants of various crops were investigated. Differential radiosensitivity among species or varieties was determined also for various plants. Extremely high relative biological effectiveness values of neutrons or other heavy particles as compared with γ or x rays were reported in higher plants. Since these high relative biological effectiveness values were obtained mainly from the irradiation of dry seeds, it is suspected that the water content of the seeds might have been a modifying factor of the values. Various methods for the selection of mutants and for the isolation of chimeras were tested and reported. Reports on the following items were introduced: chromosomal reconstruction, cross-breeding barrier, a new method of breeding by mutation, evaluation of induced mutants, and mutation in plant breeding. (Japan)

27879 EFFECT OF POLLEN IRRADIATION ON REPRODUCTIVE CAPACITY, SEEDLING GROWTH, AND VARIATION OF BETULA NIGRA. Clausen, K. E. (North Central Forest Experimental Station, Rhinelander, WI). Radiat. Bot.; 13: No. 1, 47-54(Feb 1973).

Pollen samples of Betula nigra exposed to 0, 500, 1000, 2000, 4000, and 8000 roentgens (R) of gamma radiation were used in controlled crosses. Pollen irradiation had no effect on the number of female inflorescences developing into mature catkins or on the number of seeds per catkin. Amount of filled seed and germination percentage, however, decreased as the exposure level increased; the 8000 R lots had only 17.8 and 10.9%, respectively, of the controls. Viability of the filled seeds was reduced to 59.7% after exposure to 8000 R compared with 90% or better from all other treatments. Seed from the 8000 R treatment also had a low rate of germination. Germinants having an abnormal number or shape of cotyledons increased in frequency with exposure level up to 13.3 per cent after 8000 R. Non-viable abnormal germinants similarly increased to 12.6% at 8000 R. Pollen irradiation thus has a pronounced detrimental effect on the reproductive capacity of this species. Low levels of radiation appeared to have a stimulating effect on rate and percentage of germination but these differences were not statistically significant. It is suggested that the increase in aberrant seedlings indicates that pollen irradiation may be an effective means of inducing variation in B. nigra. (auth)

27880 MUTAGEN EFFECT ON WHEATS OF DIFFERENT PLOIDY. Kraevoi, S. Ya.; Gaina, L. V. (Inst. of General Genetics, Moscow). Tsitol. Genet.; 6: No. 5, 434-438(1972). (In Russian).

The plant resistance of both wild and cultivated wheats to chemical and radiation mutagens was found to increase with an increase in genome number. The following regularities were found in the relation between a number of induced mutations and chromosome number: for chlorophyll mutations $-2n > 4n > 6$ n; for morphological mutations $-2n < 4n < 6n$; and in total for all the mutations on a genome: $2n > 6n$. (auth)

27881 STUDIES ON LIPIDS IN FRACTIONS OF SPHEROSOMES AND MITOCHONDRIA OF γ-IRRADIATED SEEDS OF PEANUTS AND WALNUTS. Bancher, E.; Washuettl, J.; Goller, H. J. (Technische Hochschule, Vienna). Z. Pflanzenphysiol.; 67: No. 5, 399-403(1972). (In German).

Spherosomes and mitochondria of cotyledons of raw and irradiated peanuts and walnuts were isolated by means of a 3-step centrifugation–partition method. The lipid content of the two fractions was analyzed by column and thin-layer chromatography. Evaluation was carried out through direct densitometry of the TLC plates. The amount of phospholipids found in the spherosomal fraction was about 0.7%. This may point to a spherosomal membrane. In the mitochondrial fraction about 27% of neutral lipids were found. This might suggest an additional storage function of these organelles. Irradiation of the plant material was carried out using a ^{60}Co cell. The influence of irradiation with 500 krad resulted in a decrease of the triglycerides and an increase of mono- and diglycerides and free fatty acids. After irradiation with 10 Mrad additional compounds containing peroxidic groups were detectable. The phospholipids lecithin and colaminkephaline proved to be rather stable. (GF)

27882 POST-REPLICATION REPAIR OF DNA IN ULTRAVIOLET IRRADIATED MAMMALIAN CELLS. No Gaps in DNA Synthesized Late After Ultraviolet Irradiation. Lehmann, A. R. (Univ. of Sussex, Brighton, Eng.). Eur. J. Biochem.; 31: No. 3, 438-445(1972).

In two mouse cell lines, alkaline sucrose sedimentation studies showed that the DNA pulse-labelled shortly after irradiation contained gaps, which by analogy with the situation in Escherichia coli, are presumed to be opposite the pyrimidine dimers. In contrast such gaps could not be detected in DNA pulse-labelled several hours after irradiation, despite the fact dimers must have been present on the template strands. A possible explanation is that gaps were still being formed, but were filled in rapidly and were therefore not detected. This hypothesis was tested as follows. Either 1 or 8 h after ultraviolet irradiation cells were pulse-labelled with ^{3}H- or ^{14}D-thymidine in the presence of theophylline. This purine inhibits the filling in of gaps presumably by binding to the DNA in the gap. Even in the presence of theophylline, the late-synthesized DNA was considerably larger than the early-synthesized DNA. This suggests that at late times after irradiation, gaps were either not formed at all opposite the dimers, or were so transient that theophylline could not bind and inhibit their filling in. A model for synthesis of DNA on templates containing pyrimidine dimers in mammalian cells, based on these findings and other recent results, is discussed. (GF)

27883 EFFECT OF CHRONIC GAMMA IRRADIATION ON GENE RECOMBINATION IN PEAS. Monti, L. M. (CNEN, Casaccia, Italy). Z. Pflanzenzuecht.; 68: No. 1, 64-72(1972).

Reciprocal crosses were performed between two pea lines, one being characterized by 10 recessive marker genes. The parents and both the plants of the reciprocal F_1 crosses were chronically irradiated in a gamma field. Data on the effects of the irradiation of the treated plants were collected and a clear dose effect appeared for all the parameters considered for estimating radiosensitivity; no difference was found between the reciprocal hybrids. An F_2 analysis was carried out on material coming from the control and the irradiated plants and recombination data among some linked marker genes were collected: no influence of the irradiation was detected on chromosome III (genes st and b) and VII (r and tl); on the contrary, recombination values among three marker genes (s, wb, k) localized in chromosome II increased after irradiation: linkage between s and wb changed from 9.5% to 14.4%, that between wb and k increased from 14.4% to 18.6% and that between s and k from 21% to 24%. The study shows that a higher frequency of crossovers can be obtained by chronic radiation treatment of F_1 plants; the results are explained on the basis of an interference of radiations in the repair concerned with the recombination process. (GF)

27884 INDUCED MUTATIONS IN HEXAPLOID WHEAT. Frogner, S.; Aastveit, K. Meld. Norg. Landbrukshoegsk.; 50: No. 22, 1-19(1971).

A Norwegian spring wheat variety Nora, commercialized 1959, was treated with various doses of neutrons, acute γ rays, and ethylenimine (EI) in 1963. A number of qualitative as well as quantitative characters were induced. Deviating types of economic and theoretical importance were checked in M_1 and M_2. Mutants were visually selected in M_2 as M_1 ear-progenies, i.e., each family originates from a single seed of an M_1 ear. Increased size and range of variation was obtained in characters like yielding capacity, earliness, strawlength, and resistance to lodging. Mutants of potential agronomic interest were isolated in M_4. Relatively uniform M_8 families superior to the mother strain in yielding capacity, test weight, resistance to lodging, and low α-amylase activity were obtained. Increased variability was also induced as to grain yield produced in relation to the total yield, strawlength, protein content, and resistance to mildew. (auth)

27885 X-RAY INDUCED MUTATIONS IN JUTE. Joseph, J. (Jute Agricultural Research Inst., Barrackpore, India); Bose, S. Sci. Cult. (Calcutta); 38: No. 8, 359-361(Aug 1972).

Dry seeds of four varieties of jute were given 10 to 100 kR doses of x radiation. The LD_{50} was determined for the different varieties and morphological abnormalities in the flowers, leaves, and stems of surviving plants were recorded. Observations of plants in the F_2 generation revealed mutations for chlorophyll and sterility. Very few chromosome aberrations were found. Genetic variations in plant height, basal diameter, number of nodes, and fiber yield were observed in the F_3 generation. (HLW)

27886 EFFECT OF X RAYS ON THE GROWTH OF THE FIRST RHIZOID IN SPORE OF OSMUNDA REGALIS. Haigh, M. V.; Howard A. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Radiat. Bot.; 13: No. 1, 37-45(Feb 1973).

Spores of the fern Osmunda regalis were germinated and x-irradiated at different stages of their growth. In sporelings that later died from radiation damage, irradiation at first metaphase or earlier inhibited the production of the first rhizoid, which normally is formed by the elongation of one of the daughters of the first division. Irradiation at first ana-telophase or later did not inhibit first rhizoid production, even at doses that killed the sister (prothallial) cells in the large majority of sporelings. The first rhizoids of radiation survivors had the same growth rate and reached the same length at 21 days as those of unirradiated prothalli. (auth)

27887 INFLUENCE OF SEASONAL VARIATION ON SURVIVAL AND YIELD OF LETTUCE IRRADIATED WITH CONSTANT RATE,

FALLOUT DECAY OR BUILDUP AND FALLOUT DECAY SIMULATION TREATMENTS. Bottino, P. J.; Sparrow, A. H. (Brookhaven National Lab., Upton, NY). Radiat. Bot.; 13: No. 1, 27-36 (Feb 1973).

Experiments were conducted to determine the effect of seasonal variation on lettuce seedling responses to ^{137}Cs gamma radiation, given a series of exposures at a constant rate (CR) for 8 or 16 hr, or as a buildup and fallout decay simulation (Bu + FDS) or fallout decay simulation (FDS) treatment for 36 hr. After irradiation the seedlings were transplanted to the field. The experiment was performed three different times during the growing season (June to September) to encompass the natural variation in climatic conditions. Comparisons among the three experiments and the four types of exposures were made for survival and yield. The Bu + FDS and FDS treatment showed no difference in survival for the three experiments but there was a slight increase in survival at later times in the season for the 16 hr CR treatment. The yield for similar total exposures continually decreased through the season regardless of the type of exposure. This decreasing yield paralleled a steady decrease in day length as the growing season progressed. The overall ratios of effectiveness at the LD_{50} for the 16 hr CR/FDS and Bu + FDS were 1.42 and 1.01, respectively, showing the greater effectiveness of the FDS treatment over the 16 hr CR treatment and the lack of difference between the FDS and the Bu + FDS treatments. However, no difference in the mean survival time occurred among the experiments or treatments. The 8 hr CR treatment was found to be almost equal to the 36 hr FDS treatment for reducing survival and yield. A statistically significant amount of growth stimulation occurred at low exposures for all treatments in the first experiment. This diminished to a minimal amount of stimulation in the third experiment. The results show the variability that can occur in radiobiological field experiments due to variation in environmental conditions. (auth)

Radiation Effects on Animals

Refer also to abstract 27778.

Man

Refer also to abstracts 27580, 27581, 28061, 29846, and 29848.

27888 (BRH-DEP-73-3, pp 8-26) PRINCIPLES OF RADIATION PROTECTION: AN EXERCISE IN JUDGMENT. Taylor, L. S. (National Council on Radiation Protection and Measurements, Washington, DC). Oct 1972.

In radiation safety and protection in industrial applications.

The basis for the development of radiation protection standards based on maximum permissible exposure doses under various circumstances are reviewed from the early 1920's to the present. Problems presented by the application of radiation protection standards to industries using ionizing radiations are considered in terms of the elements of risk and the benefits to be gained. The application of the lowest practicable personnel exposure concept is advocated with judgement suggested on deviations from the standards that are considered acceptable in terms of risk. (CH)

27889 ACUTE RADIATION EXPOSURE WITH ^{192}Ir RODS. Chone, B.; Hessek, F. (Univ., Heidelberg). Nucl. -Med., Suppl.; No. 9 Suppl., 574-578(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

The causes and the subsequent course of events are described for a radiation accident involving the rupture of the casing of a γ source during use by a group of 6 construction workers. Visible contact injuries and detectable clinical signs occurred only in one person who, unknowingly, placed the ^{192}Ir source into his coat pocket. The estimated local dose was 4000 to 8000 R, while the whole body dose estimates ranged between 100 and 200 R. Hematological damage seemed to be only local. It was too early to predict the outcome of the severe local radiodermatitis and gonadal function. (auth)

27890 FERTILITY AMONG FEMALE SURVIVORS OF THE ATOMIC BOMBS OF HIROSHIMA AND NAGASAKI. Blot, W. J.; Sawada, H. (Atomic Bomb Casualty Commission, Hiroshima). Amer. J. Hum. Genet.; 24: No. 6, 613-622(1972).

Information concerning the reproductive histories of 2,345 Hiroshima and Nagasaki women subject to varying degrees of radiation exposure from the atomic bombs of 1945 was obtained from personal interviews. From this information, the likelihood of conception over a span of years from immediately following exposure through nearly two decades later was calculated. Significant differences in percentages of marriages with conception according to practice of contraception and city of residence were found. Significant differences in rates of pregnancy by city, marriage length, and parity were also shown. However no evidence that exposure to high doses (100+ rad) of atomic radiation has impaired subsequent fertility was uncovered. (auth)

27891 EFFECT OF DIFFERENCES IN THE ELEMENTAL COMPOSITION OF HUMAN PHANTOMS ON THE ABSORBED ENERGY FRACTION OF EXTERNAL PHOTON RADIATION. Koblinger, L. (Central Research Inst. for Physics, Budapest). Acta Biochem. Biophys. (Budapest); 7: No. 2, 189-192(1972).

A number of body compositions have been published in past years. There are smaller or greater differences. The effect of these differences on results of measurements of the absorbed fractions of external photon radiations (i.e. the ratio of the absorbed and incident energies) is discussed. (CH)

27892 GENETICALLY SIGNIFICANT RADIATION DOSE DUE TO X-RAY EXAMINATIONS IN A SURGICAL CLINIC. Fischer, H. J. Muenster, Ger.; Univ. Muenster (1971). 93p. (In German).

Thesis.

As a consequence of the use of x rays in diagnostic procedures changes might be induced in irradiated patients, which will become manifest either in the patients themselves, or else as hereditary effects of radiation in later generations. The most frequently occurring effects of the latter kind are anomalies and a shift in the sex ratio. The gonad radiation dose administered in diagnostic procedures over a period of one year in a surgical clinic was weighted with the factors determining the descendants to be expected, broken down according to various groups of age of patients. The gonad doses published by Seelentag were taken as a basis and partly modified for other types of diagnostic examinations. A multiplication of the gonad dose with the above-mentioned factor yields a genetically significant gonad dose with the measuring unit REG (Roentgen equivalent genetic). This genetically significant radiation fraction is not expressed in terms of a radiation dose administered to the population of a certain area, as no such area could be defined for the clinic under review. Three groups of diagnostic procedures could be defined according to their degree of genetic relevance, of which diagnostic examinations of the urogenital tract and the abdomino-genital region are the most important procedures with regard to hereditary effects, although they represent only a small fraction of the total of diagnostic examinations. This is in accordance with findings published in the literature. (GF)

27893 PROBLEM OF DAMAGE TO FERTILITY AND GENETIC DAMAGE DUE TO HIGH RADIATION DOSES IN MAN. Brandt, R. Heidelberg; Univ. Heidelberg (1971). 47p. (In German).

Thesis.

The experience gained so far in animal experiments with respect to radioinduced damage to the fertility and genetic damage is surveyed in order to assess genetic radiation effects. Three cases are discussed where children have been born after one of the parents has been subjected to irradiation therapy because of malignant tumor growth. This is followed by a short discussion of the eugenic reasons that can be adduced in favor of a legalization of abortion. (GF)

27894 CHROMOSOME ABERRATION DOSIMETRY IN RADIOLOGICAL PROTECTION. Lloyd, D. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 1, 11-15(1972).

A brief review is made of the results of 67 blood samples studied by chromosome aberration analysis after irradiation. The cases were divided into the following four groups and the advantages of the technique pointed out in each group: possible non-uniform exposure (50 cases); over-exposure with well-defined doses (3 cases); suspected over-exposure of persons not wearing a dosemeter (3 cases); and chronic internal or external exposure (11 cases). In this group the distribution of dose estimates were compared from film badges and from chromosome aberration analysis. (UK)

27895 EFFECT OF RADIOPROTECTANTS ON THE FUNCTIONAL STATE OF THE VESTIBULAR ANALYZER. Suslova, L. N.; Efimov, V. I.; Kornilova, L. N.; Kumets, P. I.; Losev, A. A. Kosm. Biol. Med.; 7: No. 2, 45-48(1973). (In Russian).

The radioprotectants ambratine (cysteamine-hydrotartrate with pyridoxine), mexamine (5-methoxytryptamine), and vitamin-amino acid complex (amitetravite) in the tested doses produced no negative effect on the state of the vestibular analyzer and induced no decrease of the vestibular stability of animals and humans. It is suggested vestibular reactions be used in evaluating the effect of radioprotectants on the living organism. (auth)

27896 LYMPHOCYTE TRANSFORMATION TESTS BEFORE, DURING, AND AFTER EXTRACORPOREAL IRRADIATION OF THE

BLOOD. Weeke, E. (Rigshospitalet, Copenhagen). Acta Med. Scand.; 192: No. 4, 271-279(Oct 1972).

The lymphocyte responsiveness before, during, and after extracorporeal irradiation of the blood (ECIB) was investigated in 12 patients by means of lymphocyte transformation tests. Three kinds of stimulating agents were used: alogeneic cells in mixed cultures, tuberculin-purified protein derivative, and phytohemagglutinin. Before ECIB, the blast cell transformation of lymphocytes in uremic patients was identical to that of normal controls, per unit number of cells. The response per unit number of lymphocytes after stimulation with allogeneic cells and purified tuberculin was reduced significantly during ECIB but was normalized at the end of and after ECIB. The response after stimulation with phytohemagglutinin was unchanged, during as well as after ECIB. These results are compatible with the following hypothesis. The reduced immunological function of lymphocytes during ECIB is due to an accumulation of irradiation-damaged lymphocytes in the blood. After cessation of ECIB these partially damaged cells are cleared from the blood. The fraction of thymic-dependent, small lymphocytes left in the peripheral blood is therefore the same as before ECIB, although the total number is reduced. (auth)

27897 RADIATION DOSES TO PATIENTS FROM RADIONUCLIDE INVESTIGATIONS. McEwan, A. C. (National Radiation Lab., Christchurch, N.Z.). pp 145-160 of Frontiers of Nuclear Medicine. Horst, W. (ed.). Berlin; Springer (1971).

Data were collected on all in vivo radionuclide tests and treatments carried out in New Zealand over a 3 month period in 1966. For each type of investigation an assessment has been made of the radiation doses received by organs of increased uptake and by the gonads. From the statistical data of the numbers and types of investigations and treatments and the calculated gonad doses, an annual genetic dose to the population of 0.062 mrad per person was determined, of which only 0.015 mrad arose from the use of radionuclides in diagnosis. (GF)

27898 NUCLEAR POWER STATIONS. 2. Protection Standards, Release of Radioactive Substances. Lindell, B.; Tribukait, B. Laekartidningen; 68: No. 40, 4511-4519(1971). (In Swedish).

International recommendations for maximum permissible doses and their application to Swedish regulations for radiological protection are discussed. A survey was carried out covering substances produced in a reactor that may cause radiation risks. Finally, principles and rules for limitation of permissible release of radioactive materials are described. (Sweden)

27899 EXPERIMENTAL ABSORPTION APPLIED TO LUNG DOSE FROM THORON DAUGHTERS. Harley, N. H.; Pasternack, B. S. (New York Univ., NY). Health Phys.; 24: No. 4, 379-386 (Apr 1973).

The alpha dose to tracheobronchial epithelium as a function of depth into the bronchial wall was established for thoron daughters based on experimental alpha energy absorption data. The absorption data were obtained in thin films of polycarbonate, which has recently shown to have the same absorption properties as ICRP tissue. Dose curves are presented, which allow the computation of any dose rate from thoron daughters if the activity in dis/min/cm^2 deposited on the airway surface is known. To compute a yearly typical environmental lung dose, the ThB, unattached ThB, and ThC were measured in a laboratory environment. Unattached ThB in the atmosphere contributes significantly to the total alpha dose because of its efficient deposition in the upper lung. Annual dose rates in a particular New York City laboratory environment average 16 mrads/yr. (auth)

27900 CHANGES IN THE ULTRASTRUCTURE OF ERYTHROCYTE MEMBRANE SUBJECTED TO UV-IRRADIATION IN VITRO. Kabat, I. A.; Kwiatkowski, B.; Leyko, W.; Sysa, J. (Dept. of Physiology, Lodz, Poland). Experientia; 29: No. 2, 153-154 (15 Feb 1973).

The effects of uv irradiation on the ultrastructure of erythrocyte membranes of cattle, swine, and man were studied. The results indicate that irradiated erythrocyte membranes are less granular, smoother, and thinner than nonirradiated membranes and take on the appearance of old erythrocytes or erythrocytes with enzymatic defects. (ERB)

27901 COST-BENEFIT ESTIMATES FOR THE MAJOR SOURCES OF RADIATION EXPOSURE. Terrill, J. G. Jr. (Westinghouse Electric Corp., Pittsburgh). Amer. J. Pub. Health; 62: No. 7, 1008-1013(Jul 1972).

Using data collected by public agencies, it is shown that resources spent to improve medical diagnostic x-ray equipment represent a better value to the citizens than additional waste handling facilities at nuclear power plants. Public Health Service data reported in 1972 compared with 1970 show a reduction of about 2.0 mrems per year in genetically significant dose, confirming the practicability of reducing exposures associated with medical diagnostic practices. (MCG)

27902 CURRENT STATUS OF NUCLEAR MEDICINE IN JAPAN. Iio, M. (Tokyo Univ.). Proc. Jap. Conf. Radioisotop.; No. 10, 538-544(Apr 1972).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Information is presented regarding the field of nuclear medicine in Japan, the activities of academies, and situation in instruments, radiopharmaceuticals, and personnel. Although the total number of the major instruments is still limited, scanners and γ cameras, which are manufactured by domestic companies, are showing steady penetration into the Japanese market because their price has come down year by year. Although some of radioisotopes are available from the reactors of the Japan Atomic Energy Research Institute, most of them are imported from various countries, but production of radiopharmaceuticals has progressed. Radiopharmaceuticals are controlled only by the Ministry of Health and Welfare. Procedures for application for approval, investigation, and deliberation in Japan are shown. (Japan)

27903 RADIOPROTECTION FOR MEDICAL PERSONNEL. Naoun, A. (Centre Anti-Cancereux, Nancy). Rayonnements Ionis. Tech. Mes. Prot.; No. 4, 14-27(Oct 1972). (In French).

The hazards run by personnel exposed to ionizing radiations are reviewed. Small repeated dose irradiations involve long-term hazards. Such doses affect the skin, the eyes, the gonads, and the hematopoietic tissues and can cause malformations of the fetus. The exposure conditions encountered are varied. Practical preventive measures are presented for x-ray diagnosis, radiotherapy, curietherapy (use of sealed ^{192}Ir and ^{137}Cs sources), and during the utilization of nonsealed sources (external radiation hazards and contamination). The personnel are submitted to surveillance: photographic dosimetry; internal contamination measurements; and hematological examination. (France)

27904 LATE EFFECTS OF RADIOTHERAPY IN CHILDREN. Veraguth, P. (Hopital Cantonal, Lausanne, Switzerland). Radiol. Clin. Biol.; 41: No. 4, 285-297(1972). (In French).

The late post-irradiation effects of radiotherapy in children are complicated by various factors: some tissues are more radiosensitive in children than in the adult; irradiation can cause growth impairment of certain organs or of the whole body; finally there might be radioinduced tumor formation. Examples are given to illustrate the higher radiosensitivity of bony, fibro-adipose, and muscular tissues, and the post-irradiation effects in large vessels, endocrine glands as well as the mammary gland. Tumor formation is not always related to excessive radiation doses during childhood. (auth)

27905 INDUSTRIAL DIFFICULTIES IN ESTABLISHING CONTROLLED ZONES FOR OCCASIONAL OCCUPATIONS INVOLVING IONIZING RADIATIONS, PARTICULARLY THE USE OF γ OR X RAYS IN DETECTING FAULTS. Analysis and Suggestions for Solving the Problems Arising. Menetrier, J. Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.), Suppl.; No. 94, 21-26(1972). (In French).

The term Controlled Zone is used to designate an area in which the maximum permissible annual dose may be exceeded for workers not directly concerned with work involving ionizing radiations and for the public. Very large Controlled Zone areas are necessary to respect the maximum permissible dose/unit time requirements outside such areas. When using γ or x rays to detect faults, these requirements are often not fulfilled, due to economic considerations, and in consequence, frequent dosimetric control methods are applied. Workers involved with work not directly concerned with ionizing radiations are permitted a maximum permissible dose of 1.5 rem/year or 0.75 mrem/h. The public is allowed a maximum permissible dose of 0.5 rem/year or 0.25 mrem/h. A system for ensuring the radiological safety of all persons involved is presented. (auth)

27906 EARLY ADVERSE EFFECTS OF RADIATION. McLean, A. S. (National Radiological Protection Board, Harwell, Eng.). Brit. Med. Bull.; 29: No. 1, 69-73(Jan 1973).

Early adverse effects are defined as those that result in the appearance of clinical symptoms and signs at any time within a few weeks after exposure to ionizing radiations. It is pointed out that individuals exposed in accidents with critical assemblies in nuclear reactors and laboratories have provided much useful information, because those involved have been in normal health, unlike radiotherapy patients. The present state of knowledge is reviewed in outline under the following headings: general considerations, including the frequency of lymphocyte aberrations in human peripheral blood, used as an estimate of absorbed dose, and the identification of metabolites in the wine; early adverse effects; the acute radiation syndrome, the cerebral, gastrointesti-

nal and haemopoietic forms; early death; effects on particular organs especially the skin and gonads. (auth)

27907 RADIOTHERAPY OF BLADDER TUMORS: DOSE MEASUREMENTS ON A PHANTOM FOR PENDULUM IRRADIATION WITH ^{60}Co GAMMA RAYS. Dissmann, R. Muenster, Ger.; Univ. Muenster (1970). 67p. (In German).

Thesis.

The spatial dose distribution in the region of the urinary bladder was studied on a plastic skeleton phantom. Dose measurements were performed with systematic variation of the irradiation conditions such as pendulum angle, field width, depth of pendulum axis, and wedge filter in the sagittal and horizontal central team plane. Dose values from ion chamber measurements are given as isodose figures. (GF)

27908 PATIENT DOSES FROM ORTHOPANTOMOGRAPH DENTAL X-RAY EXPOSURES. Casebow, M. P. (Plymouth General Hospital, Eng.). Brit. J. Radiol.; 46: No. 543, 230-232 (Mar 1973).

A brief outline is presented of the operation of the orthopantomograph dental unit. This provides a complete orthogonal dental survey with a single film exposure by rotation of the x-ray tube about the patient's head while sitting in an upright position, with the x-ray beam horizontal. Dose distributions are presented for a section corresponding to the patient's mouth, obtained by exposing a slow film (Kodak KS 5) in a wax block shaped to an "average patient" cross section. No attempt was made to simulate bone in the block. A single orthopantomograph exposure produced two highly localized dose "hot-spots" probably in excess of 1 rad in soft tissue, with most of the patients' section irradiated to 130 mrad or more. (UK)

27909 IMMUNOGLOBULINE LEVELS (Ig G, Ig A, AND Ig M) IN BLOOD SERA OF URANIUM MINERS. Andrlikova, J.; Wagner, V. Prac. Lek.; 22: No. 6, 214-216(1970). (In Czech).

The immunoglobulin levels of Ig G, Ig A, and Ig M were estimated in blood sera of miners exposed to natural ionizing radiation in underground work places. A comparison of the group of exposed workers with a group of non-exposed subjects showed a statistically significant difference, in the case of immunoglobulin Ig G only. The levels of the other immunoglobulins were not significantly affected. When evaluating the effect of ionizing radiation it is necessary to consider the possibility of complex effects of other factors in the mining environment. (auth)

27910 VITAMIN B_{12} MALABSORPTION AFTER COBALT TELETHERAPY FOR CARCINOMA OF THE BLADDER. McBrien, M. P. (Saint Thomas' Hospital, London). Brit. Med. J.; 1: No. 5854, 648-650(17 Mar 1973).

Between 1 and 112 months after cobalt teletherapy for carcinoma of the bladder, eight out of 14 consecutively admitted patients were shown to have malabsorption of vitamin B_{12}, though none had developed a megaloblastic anemia. Each case had received a tumor and tissue maximum dose of 3,600 R and a minimum dose of 3100 R. Most were given six treatments in 18 days using a four field technique to cover the whole true pelvis. (auth)

27911 DOSE RECEIVED DURING RADIOLOGICAL EXAMINATIONS OF THE DIGESTIVE TRACT. Results Obtained with an Integrating Dosimeter. Levy, P.; Pallardy, G.; Ledoux-Lebard, G. (Univ. Cochin-Port-Royal, Paris). J. Radiol., Electrol., Med. Nucl.; 53: No. 11, 777-782(Nov 1972). (In French).

The doses received during radiological examinations of the digestive tract were measured using a remotely controlled table and a direct-reading integrating dosimeter. The measurements were made during televized radioscopy and during individual exposures. A chronometer that integrated the radioscopy exposure time and triggered off a bell after 5 min was used. The results obtained indicate that the total dose (8 to 11 R approximately) depends upon the exposure time and the radioscopy conditions, these factors depending upon the relative difficulty of the examination. Radioscopy (even televized radioscopy) must be effected using a series of short exposure times if the dangers of over exposure are to be avoided. (France)

27912 STUDIES ON APLASTIC ANEMIA. 1. Epidemiological and Clinico-Statistical Studies of Aplastic Anemia in Nagasaki City and the Surrounding Areas. Okabe, N. (Nagasaki Univ., Japan). Kyushu Ketsueki Kenkyu Dokokaishi; 21: No. 4, 239-252(Dec 1971). (In Japanese).

Epidemiological and clinicostatistical studies were performed on 108 cases of aplastic anemia in Nagasaki and the surrounding areas during the past 23 years from 1947 to 1969. The average incidence of the disease in Nagasaki is 0.93 per 100,000 population and an increasing tendency of incidence was disclosed. The survival rate of 108 cases was calculated. Within one year after the onset of the disease, 44 out of 108 cases (41.1%) died, followed thereafter by a slower death rate, and especially when patients survive 4 years after onset, they rarely die of aplastic anemia. Only 3 out of 26 cases treated in this department, however, recovered the normal blood picture. Studies of the correlation between prognosis and the signs and symptoms at the time of the first examination revealed a significantly unfavorable influence over prognosis, such as female, age at onset under 20 years of age, interval less than 3 months from onset to first examination, hemoglobin under 8 gr./dl., WBC under 1,500/c. mm., peripheral lymphocyte count under 1,100/c. mm., bleeding time over 10 min., fever over 37°C, and hypo- or aplastic bone marrow. Above all, age at onset under 20 years of age, bleeding tendency with fever over 37°C, and hypo- or aplastic bone marrow have highly significant influences over prognosis. Corticosteroids seemed to improve the survival rate during the first and second year of the disease, although no statistical difference was demonstrated at any point between the cases treated with and without corticosteroid. The possibility that the irradiation in the atomic bombing may induce the aplastic anemia as a late effect seems to be negligible. (auth)

27913 NEW GENERAL CONSIDERATIONS ON PROTECTION IN MEDICAL RADIODIAGNOSIS OR THE GENERAL PRACTITIONER AND RADIOPROTECTION. Buchet, R. (Ncker-Enfants Malades, Paris). Cah. Med. (Paris); 11: No. 15, 1298-1301(1970). (In French).

The increase in the number of radiodiagnostic studies in France is cited and the radiation burden to the population and the practitioner is evaluated. Radiation hygeine to reduce the radiation burden is outlined without going into the detail of the techniques. The problem of systematic radiological examinations is considered. It is concluded that a strict discipline can decrease considerably the doses received. (J.S.R.)

27914 NUCLEAR POWER STATIONS. 3. Hazards of Accidents and Emergency Procedures. Lindell, B.; Tribukait, B. Laekartidningen; 68: No. 41: 4641-4649(1971). (In Swedish).

Different types of reactor accidents are described. The reactor accidents that have occurred to date and their consequences for the population environment are surveyed. Emergency procedures for reactor accidents in Sweden are described. Finally, instructions are given to medical staff on how to handle persons having received high radiation doses until it is possible to consult specialists. This means doing diagnostic tests on blood to determine radiation doses. Deciding future medical treatment is also involved. (Sweden)

27915 EVALUATION OF THE PRIMARY IMMUNE RESPONSE IN UREMIA AND AFTER EXTRACORPOREAL IRRADIATION OF THE BLOOD. Weeke, E.; Bendixen, G. (Rigshospitalet, Copenhagen). Acta Med. Scand.; 192: No. 4, 267-269 (Oct 1972).

The development of cellular and humoral hypersensitivity was examined in seven uremic patients on chronic hemodialysis, following primary immunization with brucella bacteria. Both types of hypersensitivity were detected by the leucocyte migration test (LMT) and the agglutination reaction, respectively. The primary cellular response to an antigen, as measured by means of the LMT, varied with the serum creatinine level. Before dialysis, when the serum creatinine was high, the LMT was normal; after dialysis, when the serum creatinine was relatively low, the LMT was reduced. When estimations were performed shortly after dialysis treatment, i.e. at relatively low levels of serum creatinine, the seven uremic patients developed cellular as well as humoral hypersensitivity to the same extent as non-uremic controls. Three of the seven uremic patients received extracorporeal irradiation of the blood (ECIB) prior to immunization with brucella bacteria, whereas four were vaccinated without preceding ECIB. ECIB appeared neither to attenuate nor to abolish the primary immune response to brucella antigen, as measured by means of the LMT and the agglutination reactions. (auth)

27916 CHILDHOOD CANCER FOLLOWING OBSTETRIC RADIOGRAPHY. Stewart, A.; Kneale, G. W. (Oxford Univ.). Health Phys.; 24: No. 3, 359(Mar 1973).

Clarification is made of points criticized by Shore et al (Health Phys.; 24: 259 (1973)) of earlier work by the authors on the analysis of data concerning childhood cancer following obstetric radiography. (UK)

27917 RADIATION PROTECTION AND THE ELECTRON MICROSCOPE. Wallace, R. H.; Dapolito, J. A. (Albany Medical Coll., NY). Health Phys.; 24: No. 3, 355-357(Mar 1973).

Following the discovery of a radiation exposure of an individual who had worked with no radiation sources other than an electron microscope, radiation protection surveys were taken around eleven electron microscopes. Three of the instruments were found to emit unnecessary radiation due to physical deficiencies that are listed.

Several operational procedures that contributed to the emission of unnecessary radiation were discovered and are stated. From these findings the conclusion is made that these instruments are a potential source of radiation exposure. Suggested precautions are given. (UK)

27918 CATALASE, ITS ROLE AND SIGNIFICANCE IN X-RAY RADIOLOGIC PRACTICE. Capalna, S.; Pana, I. Fiziol. Norm. Patol. (Bucharest); 17: No. 4, 359-365(1971). (In Rumanian).

The role and importance of the catalase enzymatic system in the animal organism in different normal and pathologic states are discussed. Catalases have a radioprotective role due to the mechanism of peroxide decomposition that appears in the body both in normal metabolic reactions and in case of exposure of the organism to ionizing radiations. (auth)

27919 LOCAL RADIATION INJURY AND ITS SURGICAL TREATMENT. Holmstroem, H.; Johanson, B. (Sahlgrenska Sjukhuset, Goteborg). Scand. J. Plast. Reconstr. Surg.; 6: No. 2, 156-164(1972).

One hundred and seventy cases of local radiation injury were treated by excision and immediate covering of the defect by various reconstructive methods. Initial diagnosis was in 32% benign diseases, in 44% skin carcinomas, and in 24% deep malignant tumors. Postoperative histological diagnosis was nonulcerated atrophy in 24%, atrophic ulceration in 45%, necrotic ulceration in 9%, and radiation-induced malignancy in 22%. The mean interval between radiation and operation was 12 yrs in cases of nonmalignant radiation injury and 24 yrs in cases of malignant injury. In 81%, irradiation had been given to the head and neck area and in only 6% to extremities. Basal cell carcinomas were six times as common as squamous cell carcinomas. As method of reconstruction, direct 41%, transposition flap in 8%, tube pedicle flap in 14%, and bone graft in 2%. The mean number of operations per patient varied from one with reconstruction by direct suture to eight by bone grafting. Cases of malignancy generally required more operations. The mean time of postoperative control until the patient was considered cured was 1.6 yrs in nonmalignant cases. Malignant cases are controlled for the rest of their lives. The mortality rate in radiation-induced malignancy was 2.7%. One patient died during the postoperative recovery period. Surgical treatment is considered in regard to its timing and indications for different methods of reconstruction. (auth)

27920 CHRONIC PULMONARY HEART AFTER INTENSIVE IRRADIATION OF THE THORAX. Functional Respiratory and Cardiac Hemodynamic Data. Tartulier, M.; Bandet, J. (Hopital Saint-Joseph, Lyon). J. Med. Lyon; No. 1230, 875-885(5 Jun 1972). (In French).

Observations concerning a 52-year-old patient suffering from a chronic pulmonary heart insidiously appearing 3 yrs after an intensive irradiation of the thorax are presented. The respiratory functional hemodynamic conditions were established in 1968 and 1971. Pulmonary functional exploration established the existence of a ventilative restriction without any obstructive disorder in the absence of disturbances in the alveolo-capillary diffusion and pulmonary arteriovenous shunt effects. The occurrence of alveolar hypoventilation (hypoxemia and hypercapnia) and pulmonary hypertension was particularly marked when the patient exerted herself and was responsible for the progressive hypertrophia of the right ventricle. These observations suggest the systematic use of cardiopulmonary explorations capable of establishing the existence of delayed and insidious effects due to radiotherapy of the lung functions. (France)

27921 RADIATION AND LUNG CANCER. Duggan, M. J. (National Radiological Protection Board, Harwell, Eng.). Ind. Saf.; 19: No. 3, 122(Mar 1973).

The relationship between radiation dose and subsequent risk of injury, from which one could decide on an acceptable risk and so find the acceptable dose, is not known. However, there is experience of injury from occupational exposure to radiation such as the known excessive incidence of lung cancer among some groups of metal miners exposed to high concentrations of radon but there are difficulties both with dosimetry and with epidemiology of using this experience to establish dose-risk relationships. To estimate the dose received by lungs from inhalation of radioactive particles a model is needed from which the position of particle deposition in the lungs and the subsequent clearance pathways can be deduced. (UK)

27922 GENETIC EFFECTS OF LOW AND HIGH-ENERGY RADIATION. Continued and Concluded. Pasinetti, A. (Univ., Milan). Ind. At. Spatiales; 16: No. 3, 23-34(May 1972). (In French and English).

Young germ cells at the maturation stage exhibit a very low induced mutation frequency. Differences in the mutation frequency or in the distribution of the characteristics between the two sexes are noticed in the successive stages of maturity. In a population considered as a whole, the mean dose of radiation absorbed by the gonads is principally due to natural radiation and x-ray examinations. Data related to the genetic effects of radiations on the gonads are given. In addition genetic effects resulting from point mutations or chromosome aberrations in somatic cells; leukemias, or tumors are discussed. (France)

27923 FREQUENCY OF PULMONARY CARCINOMA IN MINERS FROM ORE MINES IN THE NORTH BOHEMIAN REGION. Pekarek, V.; Martinec, M.; Urbanic, J. Prac. Lek.; 22: No. 5, 161-169(1970). (In Czech).

Eleven cases of pulmonary carcinoma in miners were analyzed. Nine cases were recorded in a uranium, lithium, and tin mine with average radon concentrations in the atmosphere of 400 pCi/l; two cases were reported in calcium difluoride mines with a radon concentration of about 100 pCi/l. The cumulative radiation doses received by bronchial epithelium were estimated; they varied within the range of 2125 to 15,375 rem. The average exposure time of all affected miners was 14.9 yrs, the average age at which the pulmonary tumor was diagnosed was 53 yrs. In order to prevent such cases it is recommended to carry out informative measurements of possible radon concentrations so that effective ventilation could be ensured in time. (auth)

27924 PERSONNEL EXPOSURES DUE TO INADEQUATE LEAK TEST METHODS FOR ^{125}I SOURCES. Murphy, P. C.; Burson, Z. G. (EG and G Inc., Las Vegas, NV). Health Phys.; 24: No. 4, 443-444(Apr 1973).

After doubt was thrown on the containment of a 300 mCi ^{125}I sealed source, although routine contamination tests were negative during use of the source, thyroid counts were performed on all personnel who had handled the source. The thyroid levels ranged from a few nanocuries to a few hundred nanocuries. A review of the working patterns against thyroid level for each person pointed to the evolution of ^{125}I in a gaseous form since the source was sealed in a plastic bag when not in use and the highest doses were received by personnel who opened the bag releasing the gaseous ^{125}I. It is recommended that thought should be given to the possibility of a leak in gaseous form when leak testing ^{125}I sources and that appropriate procedures be adopted. (UK)

27925 RADIATION EXPERIMENTATION ON CHILDREN. Rummerfield, P. S. (Univ. of California, La Jolla, San Diego). Health Phys.; 24: No. 4, 446-448(Apr 1973).

The moral and legal dilemmas that arise when members of the Radiation Safety Committee are asked to sanction the use of radiation experimentally on children are discussed. The legal demarcation between the words consent and permission is discussed. Several examples of non-standard irradiations that were considered are cited and the pitfalls examined. (UK)

27926 INFLUENCE OF TISSUE INHOMOGENEITIES ON THE DOSE DISTRIBUTION FOR IRRADIATION WITH FAST ELECTRONS FROM 15 TO 42 MeV. Rottlaender, H. Heidelberg; Univ., Heidelberg (1971). 64p. (In German).

Thesis.

The dose distribution in the head region of an Alderson–Rando phantom was studied and to what extent the depth dose distribution and the structure of isodoses will be influenced by inhomogeneous tissues was examined. Small inhomogeneities such as the cavities of the os ethmoidale and os sphemoidale will have only a minor effect on the dose distribution. The investigations were carried out by means of thermoluminescence and film dosimetry. The LiF-thermoluminescent measurements yield reproducible results only if several series of measurements are performed under the same conditions, and if the chambers are prepared beforehand by appropriate thermal pretreatment. Furthermore, a correction factor was calculated for every LiF chamber in order to improve the accuracy of the measured results. The curves obtained by the different measuring methods are discussed separately and compared with each other. Such a comparison, however, will only be useful with regard to the data on deep sections, as the measured data for areas near the surface will be affected by the density graduation of the film. The difference between the results of the two methods amounts to 5 to 15% of the total dose. (GF)

27927 LATE EFFECTS OF RADIATION. Carcinogenesis. Mole, R. H. (Medical Research Council, Harwell, Eng.). Brit. Med. Bull.; 29: No. 1, 78-83(Jan 1973).

Knowledge of the incidence of radioinduced malignant disease is briefly reviewed under the following headings: pathogenesis, with particular reference to irradiation of the skin, both in experimental work and after radiotherapy, radiation damage to the immune reactions of the body, and evidence for the theory that radioinduced malignancy originates in a small cell or single small focus of cells; clinical observations, after radiation illustrated by ob-

servations of leukemia and pelvic cancers arising after pelvic irradiation; atom bomb survivors; diagnostic radiology; latent period between exposure to radiation and clinically evident cancer; age and radiosensitivity; experimental approaches. (auth)

27928 LATE EFFECTS OF RADIATION (EXCLUDING CARCINOGENESIS). Lindop, P. J. (Saint Bartholomew's Hospital, London). Brit. Med. Bull.; 29: No. 1, 74-77(Jan 1973).

The question is raised as to how early in cancer detention is radiotherapy justified. It is pointed out that cell kinetics should be considered, especially the proliferative capacity of the neoplastic lesion versus the repair properties of normal tissues, and the adaptive resistance of some neoplastic populations is mentioned. Late effects to normal tissue (excluding carcinogenesis) are briefly reviewed in outline under the following headings: late effects on some specific normal tissues, skin, kidney, lung; modifying agents used or proposed as adjuvants in radiotherapy, such as hyperbaric oxygen, or the use of high LET irradiation such as fast neutrons, π^- mesons or accelerated heavy ions; metastatic spread relevant to late radiation damage. (UK)

Vertebrates

Refer also to abstracts 27590 and 27929.

27929 (AEC-tr-7415) RADIOBIOLOGY, VOLUME XII, NUMBER 5. Translation of Radiobiologiya; 12: No. 5, 635-800 (1972). 218p.

Separate abstracts were prepared for 31 of the 33 papers appearing in this translation. The other papers discuss the distribution of ^{35}S-cystamine and its metabolites in the organoids of liver and spleen cells of mice and the influence of radioprotective agents on the content of protein SH groups in cells of the liver and epithelium of the crypts of the small intestine of mice. (ERB)

For abstracts of individual papers see: 27370, 27805-27807, 27818, 27829-27831, 27856-27859, 27930-27943, 27984, 27996-27998, and 29347.

27930 (AEC-tr-7415, pp 13-19) ROLE OF ADRENAL HORMONES IN THE PRIMARY RADIATION DAMAGE TO SUPERMOLECULAR DNA OF RAT TISSUES. Strazhevskaya, N. B.; Struchkov, V. A. (Inst. of Biological Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 644-648 (1972).

It was shown that the effect of the drop in the elastoviscosity of supermolecular DNA (SM DNA) of the thymus and liver of adrenalectomized irradiated rats is analogous to the effect in intact irradiated rats (1 kR). It was concluded that the adrenal hormones do not play a significant role in the primary radiation damage to SM DNA in vivo. The hormonal regulation of SM DNA was confirmed: an increase in the elastoviscosity of SM DNA of 16 and 24% in comparison with the control was detected in the thymus and liver of adrenalectomized rats, respectively. On the contrary, the administration of cortisone and deoxycorticosterone to rats led to a rapid drop in the elastoviscosity of SM DNA of the thymus and liver, the magnitude of the effect depending on the dose of the hormone and the rat tissue. (tr-auth)

27931 (AEC-tr-7415, pp 20-26) BINDING OF ACTINOMYCIN D TO DEOXYRIBONUCLEOPROTEINS FROM THE ORGANS OF IRRADIATED ANIMALS. Paskevich, I. F.; Stolyarov, I. V.; Likhoded, V. S. (Inst. of Medical Radiology, Kharkov). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 649-653(1972).

The ability of actinomycin D for binding to chromatin, DNA, $DNP_{0.4}$, and $DNP_{0.6}$ in the livers and spleens of irradiated rats was studied. It was established that in the liver after irradiation, the degree of binding of the antibiotic to the chromatin and DNP is increased in comparison with the control. In the spleen an increase in the binding is observed only in the long-term periods after radiation lesion (120 hrs). It is suggested that the increase in the binding of actinomycin is explained either by derepression or by a disruption of the macromolecular structure of the DNP complex. (tr-auth)

27932 (AEC-tr-7415, pp 33-41) INFLUENCE OF VINBLASTINE ON THE RADIOSENSITIVITY AND NUMBER OF COLONY-FORMING UNITS (CFU) IN THE BONE MARROW AND ON THE SURVIVAL OF IRRADIATED MICE. Konoplyannikov, A. G.; Baisogolov, G. D.; Semina, O. V.; Poverennyi, A. M. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 659-665(1972).

The influence of the antimitotic preparation vinblastine (2-3 mg/kg of body weight) on the number and radiosensitivity of the CFU was evaluated in experiments on mice by the method of exo- and endogenous colonies. It was discovered that after intraperitoneal injection of vinblastine, the number of CFU increases, reaching the largest value after 4 days; together with the increase in the largest value after 4 days; together with the increase in the number of CFU, their radiosensitivity increases. When vinblastine is introduced 2 days before γ irradiation, the survival of mice is increased in comparison with the control, and the DRF for vinblastine is about 1.2. The change in the radiosensitivity of the CFU may be the cause of the lack of agreement of estimates of the radioprotective action of vinblastine and other preparations according to tests of survival and the number of endocolonies. (tr-auth)

27933 (AEC-tr-7415, pp 42-48) INFLUENCE OF PARTIAL SHIELDING OF THE BONE MARROW ON THE FUNCTIONAL STATE OF THE INTESTINAL EPITHELIUM IN MICE AFTER IRRADIATION. Kuzina, V. A. (Central Scientific Research Inst. of Roentgeno-Radiology, Leningrad). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 666-670(1972).

The change in the hydrolytic function of the intestines was investigated (according to the data on the invertase activity) for 30 days in mice irradiated at a dose of 600 R totally and with shielding of one shin. The enzyme activity was disturbed substantially less in protected mice, and its recovery was also more rapid and complete in comparison with the irradiated control. The data on survival, change in body weight, and clinical observations in the period of development of the intestinal syndrome also are evidence of the presence of a positive influence of the shielded portion of the hemopoietic tissue on the postradiation response of the intestines. (tr-auth)

27934 (AEC-tr-7415, pp 65-73) KINETICS OF THE RESTORATION OF THE IMMUNE RESPONSE IN MICE IRRADIATED AT A LETHAL DOSE WITH SHIELDING OF A HIND LIMB. Petrov, R. V.; Pantaleev, E. I.; Khaitov, R. M. (Inst. of Biophysics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 681-687(1972).

In the case of irradiation of mice of the CBA line with x rays with shielding of the right hind limb, just as in syngeneic radiation chimeras, complete restoration of the immune response was not observed over a long period of time. And yet, at the early stages after irradiation, the immune response of the shielded animals is higher than in chimeras, but it decreases on the 21st postradiation day. The level of the secondary response in radiation chimeras and shielded mice is similar, which is evidence of the same mechanism of the origin of immunological memory. Transplantation of syngeneic lymphocytes provides for increased ability to manufacture antibodies and accumulate antibody-forming cells in the spleens of the shielded mice, which is evidently explained by cooperative interaction of endogenous stem cells and introduced lymphoid cells. (tr-auth)

27935 (AEC-tr-7415, pp 82-90) MORPHOLOGY OF NEUTRON DAMAGE TO MICE, RATS, AND GUINEA PIGS. Monastyrskaya, B. I.; Sverdlov, A. G. (Ioffe Inst. of Physics and Tech., Leningrad). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 694-700(1972).

The dynamics of the weight and morphological changes in the spleen, thymus, adrenals, liver, and small intestines of mice, rats, and guinea pigs after single neutron and x irradiation were studied. The same nature of the injurious effect and the development of regeneration after both types of irradiation were demonstrated. The differences in the course of the postradiation process were determined in different species of animals. It was established that in the case of the intestinal syndrome in mice there is no death of epithelium of the mucosa and denuding of villi in the small intestine. Guinea pigs are characterized by the development of a hemorrhagic syndrome, which is the cause of death of the animals in periods that are shorter, the larger the dose. The intestinal syndrome in guinea pigs does not develop after x irradiation in doses up to 1300 R or neutron irradiation at a dose of 200 rad. (tr-auth)

27936 (AEC-tr-7415, pp 131-133) CHANGE IN THE CONCENTRATION OF FREE KININS IN THE BLOOD OF ANIMALS DURING ACUTE RADIATION SICKNESS. Gaponyuk, P. Ya.; Kalinkina, T. N.; Gaponyuk, E. I. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 735-737(1972).

In experiments on Wistar rats, subjected to whole-body γ irradiation with ^{60}Co at a dose of 800 R (41 R/sec), an increase in the concentration of free kinins in the blood was demonstrated on the second to fourth day after irradiation. The increase in the concentration of free kinins in the blood coincided in time with the development of gastrointestinal disorders in the irradiated rats and with their death rate peak. The data obtained permit us to assume the participation of kinins in the pathogenesis of acute radiation sickness. (tr-auth)

27937 (AEC-tr-7415, pp 134-139) STUDY OF THE CHANGE IN THE ANTIOXIDANT ACTIVITY OF LIPIDS OF CERTAIN ORGANS OF MICE IN THE EARLY PERIODS AFTER IRRADIATION AND EFFECTS OF INHIBITORS OF RADICAL PROCESSES. Pal'mina, N. P. (Inst. of Chemical Physics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 737-742(1972).

The change in the antioxidant activity of lipids (AOA) of the spleen and liver of mice of the BALB line was studied during the first day after irradiation (650 R) and subsequent administration of 6-methyl-2-ethyl-3-hydroxypyridine, which exerts a radioprotective effect. The change in the AOA of these organs after irradiation and administration of the preparation is of a periodic nature; this is correlated to a definite degree with the literature data on the radiosensitivity of the whole organism. The experimental data obtained permit it to be assumed that the AOA of the spleen plays a significant role in the sensitivity of the organism to the action of radiation, while the change in this quantity can serve as one of the tests for developing methods of a rational theory of radiation sickness. (tr-auth)

27938 (AEC-tr-7415, pp 146-149) CONTENT OF UBIQUINONE IN WHOLE TISSUE AND MITOCHONDRIA OF THE RAT LIVER AFTER X IRRADIATION. Zaslavskii, Yu. A.; Kolomiitseva, I. K.; Akoev, I. G. (Inst. of Biological Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 746-749(1972).

The content of ubiquinone in whole tissue and mitochondria of the rat liver was investigated. After x irradiation, the total amount of ubiquinone in the rat liver increased. The change in the amount of reduced ubiquinone was greater than in the amount of oxidized ubiquinone. The ratio between the oxidized and reduced forms of ubiquinone did not change significantly. The postradiation changes were observed chiefly in the extramitochondrial ubiquinone. (tr-auth)

27939 (AEC-tr-7415, pp 150-154) EXCRETION OF CATECHOLAMINES WITH THE URINE AFTER WHOLE-BODY IRRADIATION, ADMINISTRATION OF CYSTAMINE, AND A COMBINATION OF THEM. Kulinskii, V. I.; Linetskaya, L. S. (Krasnoyarsk Medical Inst., USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 749-752(1972).

Whole-body irradiation of rats at a dose of 850 rad sharply increased the excretion of noradrenaline (NA) after one day; normalization occurred by the third day. In the hematogenic form of acute radiation sickness, on the fifth to eighth days a second wave of hypernoradrenalinuria arose. Before this, the excretion of NA was reduced, while that of adrenaline (A) increased sharply. In the intestinal form, before death (on the third to fourth day), the excretion of NA decreased sharply, while that of A was unchanged. Cystamine (CA) caused a very high excretion of A on the first day, but did not change the excretion of NA. Under the joint influence of CA and irradiation, their early effects were frequently mutually inhibited. The second wave of hypernoradrenalinuria did not develop in the protected animals. (tr-auth)

27940 (AEC-tr-7415, pp 159-164) DEPENDENCE OF THE RADIOPROTECTIVE AND METHEMOGLOBIN-FORMING ACTION OF CERTAIN ALIPHATIC-AROMATIC AND AROMATIC KETONES ON THEIR CHEMICAL STRUCTURE. Vladimirov, V. G.; Kostyukovskii, Ya. L.; Nenarokova, L. I.; Pvalova, L. V.; Slavachevskaya, N. M. (Military Medical Academy, Leningrad). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 755-759(1972).

Thirteen preparations belonging to the class of propio- and benzophenones were synthesized and investigated in experiments on mice for radioprotective and methemoglobin-forming activity. It was shown that the radioprotective action of most of the investigated preparations is directly dependent on their methemoglobin-forming ability. The manifestation of the latter necessitates the presence of a free amino group in the molecule. Three compounds possessing moderate radioprotective activity and not causing the development of methemoglobinemia in the animals were discovered. (tr-auth)

27941 (AEC-tr-7415, pp 170-174) INFLUENCE OF SEX, STARVATION, AND TIME OF YEAR ON THE CONTENT OF QUINONES IN THE LIVERS OF IRRADIATED RATS. Katin, V. I.; Fomenko, L. A. (Inst. of Biological Physics, Pushchino, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 763-767 (1972).

The influence of seasonal fluctuations, starvation, and the sex of the animal on the accumulation of quinones (Q) in the livers of intact and irradiated (2000 R) rats was investigated. The content of Q varied depending on the season, on starvation, and on the sex of the animal. The maximum level of Q is noted in December and May, and the minimum level in August and March. The amounts of Q in the livers of males was somewhat higher than in the livers of females. During starvation, a substantial reduction of the content of Q was observed. The concentration of Q was unchanged one day after irradiation of satiated rats, whereas after irradiation of starving rats it was approximately doubled. (tr-auth)

27942 (AEC-tr-7415, pp 179-183) INFLUENCE OF EXTERNAL GAMMA IRRADIATION ON THE KINETICS OF THE METABOLISM OF TRITIUM OXIDE. Katsapov, I. S. (Inst. of Biophysics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 770-773(1972).

The influence of external γ irradiation on the kinetics of the tritium oxide metabolism was studied. Rats were subjected to a single whole-body γ irradiation at a dose of 300 R, 30 min, 14, and 30 days after irradiation, and the nonirradiated animals received an intraperitoneal injection of tritium oxide in a dose of 0.05 mCi/g. The processes of excretion of tritium oxide in the irradiated animals are disturbed during the first 2 weeks; the incorporation of the isotope into the dry residue of the organs is increased, and the greatest changes are detected when the isotope is administered 30 min after irradiation. (tr-auth)

27943 (AEC-tr-7415, pp 193-196) CHANGE IN THE ZINC CONTENT IN THE ORGANS OF RABBITS UNDER THE INFLUENCE OF X RAYS. Luk'yanchuk, I. I.; Gotsulyak, L. E. (Odessa Medical Inst.). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 780-782(1972).

A single whole-body irradiation of rabbits with x rays at a dose of 450 R produces substantial changes in the zinc content in the liver, small intestines, kidneys, muscles, and blood. The nature of the changes in the content of zinc in the investigated organs and tissues of irradiated rabbits depends on the type of tissue, as well as on the time after irradiation. (tr-auth)

27944 (AEC-tr-7418) EFFECT OF IONIZING RADIATION ON THE ORGANISM. The Problem of the Effect of Radioactive Water Pollution on the Reproduction of Commercial Fishes. Sorokin, B. P. (Ed.). Translation of Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanorg.; No. 29, 1-182(1971). 219p. Dep. NTIS.

Separate abstracts were prepared for the 16 articles in this English translation publication. (HLW)

For abstracts of individual papers see: 27945—27949, 27999—28006, 28046, 28069, and 28070.

27945 (AEC-tr-7418, pp 53-65) HISTOGENESIS AND FUNCTIONING OF THE HYPOPHYSIS AND THYROID GLAND IN THE LARVAE OF ATLANTIC SALMON EXPOSED TO IONIZING RADIATION. Oganesyan, S. A. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 45-54(1971).

In the thyroid gland of larvae whose embryonal period transpired with chronic exposure to radiation, characteristic degenerative changes and impairments in release of the secretion can be observed. In the hypophysis one can detect growth of the parenchyma, consolidation of nuclei and an increased mitotic activity. Total irradiation in doses of 350 and 1000 R causes phase changes in the thyroid gland, expressed during the first stage in an intensification and later in a depression of secretory activity. Effects of x radiation, strontium-90, and yttrium-90 were studied. (HLW)

27946 (AEC-tr-7418, pp 75-88) CHANGE IN PERIPHERAL BLOOD IN THE EMBRYOS AND LARVAE OF ATLANTIC SALMON UNDER THE INFLUENCE OF RADIOACTIVE CONTAMINATION OF THE WATER AND X RAYS. Kosheleva, V. V. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 62-73(1971).

A study was made of the effect of chronic exposure to $^{90}Sr + ^{90}Y$ of different concentrations on the morphological composition of the red blood of Atlantic salmon embryos and larvae. In the egg blastula stage in the aquarium with $^{90}Sr + ^{90}Y$ with an activity of $2 \cdot 10^{-5}$ curie/liter there was additional irradiation by x rays in a dose of 350 R. It was established that a characteristic manifestation of the action of $^{90}Sr + ^{90}Y$ is a considerable depression in the rate of maturing of formed blood elements and the appearance of cells with different morphological changes. The degree of the radiation effect increases with an increase in the radioactive isotope in the water. With a combined exposure there were no additional changes with respect to the variant with $^{90}Sr + ^{90}Y$ ($2 \cdot 10^{-5}$ curie/liter). (auth)

27947 (AEC-tr-7418, pp 100-112) EFFECT OF X IRRADIATION ON THE GAMETES AND EMBRYONAL CELLS OF THE ATLANTIC SALMON. Migalovskaya, V. N. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanorg.; No. 29, 82-90(1971).

A study was made of the influence of small radiation doses (50, 150, and 350 R) on the fertilizing capacity of sperm and on the frequency of chromosomal aberrations in the cells of Atlantic

salmon embryos in the blastula and gastrula stages. These radiation doses did not cause an appreciable decrease in the fertilizing capacity of the sperm. The percentage of fertilization in the control and in all the experimental variants was at the same level. The criterion for radiation damage to the nucleus was the frequency of the late anaphases with bridges and fragments. Statistically reliable differences were obtained for the frequency of chromosomal aberrations in all the studied stages of development between the control and the 350-R variant. Radiation damage to the nuclear apparatus presisted at approximately the same level during embryogenesis of the Atlantic salmon. No decrease in mitotic activity was noted during the studied development stages. With irradiation of the dividing egg in the blastula stage in a dose of 350 R there was a temporary lag in mitotic divisions and also an increase in the frequency of chromosomal aberrations. The chromosomal aberrations were represented for the most part by individual bridges and fragments. Multiple bridges and multipolar mitoses were encountered in individual cells. (auth)

27948 (AEC-tr-7418, pp 134-141) EFFECT OF X IRRADIATION ON THE INCORPORATION OF GLYCINE-^{14}C IN THE TISSUE OF ATLANTIC SALMON LARVAE. Kas'yanov, V. L.; Lukina, N. A. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 110-115(1971).

Atlantic salmon (Salmo salar L.) larvae at an age of one day after hatching were irradiated by x rays in a dose of 350 R. One, four, and eight days after irradiation the larvae were placed for 16 hours in an aqueous solution of glycine-^{14}C with a given concentration. The degree of incorporation was judged from the number of grains of reduced silver on radioautographs of sections of the liver and skeletal muscles (over an area of 100 × 100 u). The incorporation of glycine-^{14}C into the tissues of irradiated larvae was greater than its incorporation into these same tissues of control larvae at all research times (the difference was statistically significant). The incorporation of glycine-^{14}C into the liver for an identical area of section is greater in comparison with incorporation into the skeletal muscles both in the control and in the experiment. (auth)

27949 (AEC-tr-7418, pp 166-194) RADIATION REACTION OF THE ADENOHYPOPHYSIS-GONADS SYSTEM IN COLD-BLOODED ANIMALS. Kashchenko, L. A. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 135-158(1971).

In experiments with local and general irradiation a study was made of the interrelated radiation reaction of the adenohypophysis and gonads (ovaries and testes) in the grass frog. Not essentially differing from the reaction of these glands in higher animals, the radiation reaction of the adenohypophysis and gonads in the frog is characterized by some specific features associated with the anatomical-physiological peculiarities of the species. These include poor reversibility of radiation damage to the testes, high morphological radioresistance of structural elements of the ovary, and high radiotolerance and repairability of the adenohypophysis. As a result of irradiation there is an impairment or a complete disruption of the functional relationship between the glands. This brings about the development of two processes which mutually supplement one another: damage to the mechanisms of the synthesis and release of hormones and damage to mechanisms responding to endogenous (hormonal) stimulators. Radiation damage develops as a process leading to system disintegration. With respect to its physiological aftereffects this process is comparable to surgical removal of the glands. (auth)

27950 (BNWL-1650(Pt. 2), pp 2.1-2.37) TERRESTRIAL ANIMAL ECOLOGY. Dec 1972.

In Pacific Northwest Laboratory annual report for 1971 to the USAEC Division of Biology and Medicine. Volume I. Part 2.

The effects of the quality and quantity of food available on the population densities and species composition of small animals of an arid land ecosystem were studied. The populations of mule deer and Canada geese on the Hanford reservation were also estimated. Data are included from a study on the effects of acute ionizing radiation at doses spanning the median lethal response on the ability of a population of pocket mice (Perognathus parvus) to survive in a free-ranging or laboratory environment. The fallout ^{137}Cs body burdens of Eskimos of various age groups living in Anaktuvuk Pass, Alaska, during 1971 were measured. The ^{137}Cs content in tundra vegetation was measured during 1971. A comparison with results of measurements made in 1961 showed little change. It was concluded that ^{137}Cs may persist for many years in a vegetation mosaic that is subject to little modification through the activities of people. (CH)

27951 RADIOISOTOPIC RENOGRAPHY IN RABBITS AFTER IRRADIATION AND AFTER APPLICATION OF AET. Dienstbier, Z.; Blazek, T.; Brousil, J.; Raban, P.; Pospisil, J. (Charles Univ., Prague). Nucl. -Med., Suppl.; No. 9 Suppl., 260-264(1971).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

By means of ^{131}I-hippurate renography the effects of whole-body x irradiation and application of radioprotective compound AET (aminoethyl-isothiuronium BrHBr) were studied in rabbits. Irradiation evidently caused an acelerated penetration of radiopharmaceutical compound; on the contrary the AET application showed a contradictory effect. The mechanism of these changes, which are conditioned by vasodilatation or vasoconstriction of the vascular system, is discussed simultaneously with further clinical and laboratory findings which were estimated after irradiation and after application of AET. (auth)

27952 NEW RESTRAINING DEVICE FOR TESTING ANTI-RADIATION DRUGS IN MONKEYS. Withrow, G.; Devine, M. C. (Walter Reed Medical Center, Washington, DC). Lab. Anim. Sci.; 22: No. 3, 419-421(Jun 1972).

A new restraining device for irradiating monkeys is described. The restraint was of particular use in testing chemical compounds for radioprotective action. The device afforded complete restraint of untrained monkeys during irradiation with little or no local skin irritation. A cage specially designed to transport the monkeys secured in the restraining device is also described. (auth)

27953 RADIATION INJURY. Casarett, G. W. (Univ. of Rochester, NY). pp 103-122 of Surgery Annual 1972. Cooper, P. (ed.). New York; Meredith Corporation (1972).

The nature and mechanisms of induction of pathologic effects of ionizing radiations in mammalian organs and tissues are reviewed. It is pointed out that despite substantial understanding of the basic physical events in the absorption of radiation energy and an extensive knowledge of the various manifestations of radiation injury in cells, the fundamental mechanisms of the cellular effects of radiation are not yet completely known. The known effects of ionizing radiation, whether caused by direct or indirect mechanisms, are qualitatively similar for different kinds or qualities of ionizing radiations, although they vary quantitatively according to the amounts of radiation energy absorbed (dose) and differences in concentrations of ions produced by various kinds of radiations, with the relative biological effectiveness (RBE) of the radiations varying directly with specific ionization or linear energy transfer (LET). Present knowledge indicates that the effects of radiation are all injurious, and the temporary stimulation of activity observed in some irradiated cells precedes radiation injury. During and following irradiation many diverse degenerative processes may occur simultaneously with recuperative processes in various cells in a tissue. Reaction mechanisms involved in the accumulation of irreparable radiation injury and in the recovery of irradiated cells are reviewed. (CH)

27954 EXPERIMENTAL REORGANIZATION OF THE CEREBELLAR CORTEX. I. Morphological Effects of Elimination of All Microneurons with Prolonged X-irradiation Started at Birth. Altman, J.; Anderson, W. J. (Purdue Univ., Lafayette, IN). J. Comp. Neurol.; 146: No. 3, 355-405(Nov 1972).

The heads of Long-Evans rats were irradiated from birth with a schedule of repeated doses of low-level x-rays, which prevented the acquisition of the postnatally-forming basket, stellate, and granule cells. The absence of these microneurons led to several changes in the organization of the cerebellar cortex, studied at 30 days of age with light and electron microscopy. The somata of Purkinje cells were not strung out in a monolayer. The dendritic thorns, in addition to forming true synapses, also established pseudosynapses with glial processes and synapses devoid of vesicles with the surface or the interior of Purkinje cell dendrites. The latter type of contact apparently led to autolysis of part of the dendrite, which was the only clear pathological phenomenon observed. These results indicated considerable autonomy in the growth of Purkinje cell dendrites, which arborized richly and sprouted innumerable small processes in the absence of parallel fibers, and formed postsynaptic dense membranes in contiguity with inappropriate processes, such as those of Purkinje cells or astrocytes. (auth)

27955 IMPAIRMENT OF RAT HEPATIC MICROSOMAL DEMETHYLATING ACTIVITY AND STRUCTURAL PROTEIN AFTER X-IRRADIATION OF THE HEAD. Kvasnickova, E.; Lejsek, K.; Hais, I. M. (Charles Univ., Hradec Kralove, Czech.). Biochem. Pharmacol.; 22: No. 2, 275-277(Jan 1973).

Heads of rats were exposed to 1000 R of x radiation and electrophoretic patterns of liver microsomal protein, pethidine-demethylating activity, total microsomal protein, and cytochrome P-450 levels were studied. Results suggest that the decrease of pethidine-demethylating activity in rat liver microsomes and the disappear-

ance of two components from the microsomal structural protein following whole-body irradiation are not caused by direct impairment of liver endoplasmic reticulum. (HLW)

27956 ROLE OF THE PHAGOCYTE IN HOST-PARASITE INTERACTIONS. XXXVIII. Metabolic Activities of the Phagocyte as Related to Antimicrobial Action. Sbarra, A. J.; Paul, B. B.; Jacobs, A. A.; Strauss, R. R.; Mitchell, G. W. Jr. (Saint Margaret's Hospital, Boston). AT(11-1)-3517-72. RES, J. Reticuloendothel. Soc.; 12: 109-126(Aug 1972).

A literature review is presented of the relation of stimulated metabolic events to antimicrobial activity of polymorphonuclear leukocytes. Studies on the effects of whole-body x irradiation of guinea pigs showed a decrease in phagocytic and bactericidal functions of polymorphonuclear leukocytes. It was observed that if the thoracic area was lead shielded during irradiation the changes in these functions were minimal. When the leukocytes were irradiated in vitro the phagocytic and bactericidal functions were not reduced. (HLW)

27957 ROLE OF THE LIVER IN THE MECHANISM OF REDUCTION OF BLOOD SEROTONIN CONCENTRATION DURING ACUTE RADIATION SICKNESS. Dorofeev, V. M.; Zyablitskii, V. M.; Soboleva, E. L.; Nestaiko, G. V. (Research Inst. of Medical Radiology, Obninsk, USSR). Byull. Eksp. Biol. Med.; 75: No. 1, 33-34(Jan 1973). (In Russian).

Experiments were performed on 30 rabbits irradiated in a dose of 600 R (^{60}Co gamma rays and a dose rate of 120 R per min). The process of serotonin delivery from the enterochromaffine cells of the intestine to the blood was not disturbed at the height of acute radiation sickness; in irradiated animals a considerable part of serotonin contained in the blood outflowing from the intestine was destroyed in the liver (this did not occur in intact rabbits). There was a sharp increase in the activity of monoamino-oxidase at the height of acute radiation sickness. (auth)

27958 RATE OF RECOVERY OF RADIORESISTANCE DURING THE COMBINED ACTION OF IONIZING RADIATION AND DYNAMIC FLIGHT FACTORS ON AN ORGANISM. Dobrov, N. N.; Kazlov, V. A.; Parshin, V. S.; Saksonov, P. P. Probl. Kosm. Biol.; 14: 271-285(1971). (In Russian).

Mice were ^{60}Co γ-irradiated to a total dose of 250 to 600 R at a dose rate of 12 to 18 R/min. Centrifugation and/or vibration (70 Hz, 0.5 mm amplitude for 1 hr) were administered before, after, or before and after irradiation. Radiation damage was estimated from changes in the LD and the spleen weight. Radioresistance and rate of recovery after irradiation were lowered by all treatments, especially after centrifugation. (ERB)

27959 STUDIES ON THE RADIOBIOLOGY OF A RAT SARCOMA TREATED IN SITU AND ASSAYED IN VITRO. Dawson, K. B.; Madoc-Jones, H.; Mauro, F.; Peacock, J. H. (Royal Marsden Hospital, Sutton, Eng.). Eur. J. Cancer; 9: No. 1, 59-68(Jan 1973).

Some of the characteristics of a rat sarcoma, induced by subcutaneous implantation of a plastic film, (visking cellulose), are described. Cells from this tumor can be plated routinely into dishes with a plating efficiency of about 2.6% and survival can be assayed by a direct in vitro cloning technique. The cultured cells, when reinjected intradermally in rats, give rise to solid tumors similar in appearance and histology to the tumor of origin. X-irradiation experiments were performed by treating the tumor cells either in situ or in vitro and by assaying the survival either in vivo or in vitro. The results indicated that the survival of tumor cells irradiated in situ was greater than that of cells irradiated in vitro independently from the assay being done either in vivo or in vitro. This difference could not be accounted for even if it was assumed the cells in situ were completely anoxic. Further experiments demonstrated that the cells in situ are normally sensitive to the synchronizing (lethal and blocking) action of hydroxyurea and that hydroxyurea-synchronized populations exhibited an x-ray age response similar to that of other systems in terms of the course of the survival variations during the cell cycle (but not in terms of radiation dose). (auth)

27960 EFFECTS OF X RAYS ON THE MUCOPOLYSACCHARIDE CONTENT OF SERUM AND ASCITES FLUID IN RATS WITH YOSHIDA ASCITES HEPATOMA. Ilieni, M. T.; Gelsomino, M. R. (Univ., Pavia, Italy). Boll. Soc. Ital. Biol. Sper.; 47: No. 9, 249-250(1971). (In Italian).

Yoshida ascites tumors were transplanted into 60 rats, and 8, 12, and 20 days later 30 rats were given whole-body x radiation. Twenty days later the unirradiated rats showed an increase of 6.3 to 6.5 mg % of mucopolysaccharides. The mucopolysaccharides decreased in the irradiated rats. In the ascites liquid the mucopolysaccharide values were 5.7 to 6.10 mg % in the unirradiated controls at 8 to 20 days and from 2.2 to 3.4 mg % in the irradiated rats. In the serum and ascites fluid from irradiated rats the protein fraction was reduced. Evidence is presented for a necrosis and degeneration of the tumor. (HLW)

27961 EFFECT OF POST-IRRADIATION USE OF PRODIGIOZAN ON SURVIVAL AND BLOOD SYSTEM OF IRRADIATED ANIMALS. Ermol'eva, Z. V.; Vaisberg, G. E.; Dikovenko, E. A.; Elistratova, Zh. V. (Central Post-Graduate Medical Inst., Moscow). Antibiotiki; 17: 517-522(Jun 1972). (In Russian).

Prophylactic and therapeutic effects of prodigiozan used in doses of 15, 30, and 60 γ on survival and hemopoesis of mice irradiated with 780 R ($LD_{60-65\%}$) were compared. The survival level of the mice treated with 15 to 60 γ of prodigiozan 30 minutes after the irradiation was 1.7 times higher than that of the control animals. When prodigiozan was used 24 hours before the irradiation, the survival level of the mice was 2 times higher than that in the control group irradiated under the same conditions. In addition, the same doses of prodigiozan markedly stimulated reparation of the blood-forming tissues in the irradiated mice at earlier phases of reparation (the colony number in the spleen, cytosis of the bone marrow counts of thrombocytes, reticulocytes and leucocytes in the peripheral blood) irrespective of whether the drug was administered before or 30 minutes after the irradiation. (auth)

27962 COMPARATIVE STUDY OF THE EARLY EFFECTS OF NEUTRON GAMMA RADIATION ON THE SIDMAN AVOIDANCE PERFORMANCE OF RHESUS MONKEYS AND BABOONS. Wilkinson, J. E. Waco, TX; Baylor Univ. (1972). 105p. University Microfilms Order No. 73-7326.

Thesis (Ph. D.).

Groups of rhesus monkeys (Macaca mulatta) and baboons (Papio papio) were trained to Sidman avoidance schedules under one of two task conditions. Eight members of each species were trained to a schedule with a five second response-shock (RS) interval, and seven members of each species were trained to a schedule with a twenty second RS interval. The shock-shock (SS) intervals for the two conditions were two seconds and five seconds, respectively. Following training baseline data were collected and then the subjects were irradiated with approximately 3,500 rads of neutron-gamma radiation delivered in a single pulse. Data were collected for two hours post-radiation. Response rate, numbers of RS and SS shocks, and measures of response timing were computed for each thirty-minute period of each session. Medians and median tests were computed for all variables at each thirty-minute period. The results indicated that the baboons underwent severe performance decrement in the first thirty minutes post-exposure, but usually recovered baseline performance levels sometime during the two-hour post-radiation observation period. The rhesus monkeys showed a less reliable pattern of performance decrement generally characterized by high shock probabilities in the second thirty-minute post-radiation observation period, with less subsequent recovery than for the baboons. (Diss. Abstr. Int., B)

27963 MOLECULAR REACTIVITY OF THE CONJUNCTIVE FIBERS IN THE CONDITIONS OF IRRADIATION WITH X-RAYS. Cristea, M.; Carpen, E.; Muresanu, D.; Rosca, C.; Olinic, A.; Gocan, M.; Radu, M. Cluj. Med.; 44: No. 3, 623-629(1971). (In Rumanian).

The molecular reactivity of the collagenic fibers of the uterus corion was studied in 62 adult rats, following irradiation with x rays. The behavior of the polar aminoacids of the polypeptidic chains was observed. The studies were carried out by means of histochemical methods and examinations under phase-contrast and polarized light microscopes. The disorganization of the collagenic fibers was observed, followed by their recovery, their increase, and their thickening. The studies showed, at the level of the injured fibers, modifications of the amino, guanidyl, and phenol radicals accompanied by modifications of the optical properties. (Rom. Sci. Abstr.)

27964 POTENTIAL ANTIRADIATION AGENTS. p-Anisylbutyl Derivatives of S-2-Aminoethyl Hydrogen Thiosulfate, 2-Aminoethanethiol, the Corresponding Disulfide, and Thiazolidine. Westland, R. D.; Holmes, J. L. (Parke, Davis and Co., Ann Arbor, MI). J. Med. Chem.; 15: No. 9, 976-978(Sep 1972).

The radioprotective effectiveness of p-anisylbutyl derivatives of S-2-aminoethyl hydrogen thiosulfate, 2-aminoethanethiol, the corresponding disulfide, and thiazolidine was determined in mice. (ERB)

27965 POSSIBLE INFLUENCE OF SINUSOIDAL BLOOD VOLUME ON THE X-RAY DOSE DELIVERED TO THE MARROW OF TRABECULAR BONE IN THE RAT. Maillie, H. D.; Eddy, H. A.; Mermagen, H. (Univ. of Rochester, NY). Health Phys.; 24: No. 3, 353-355(Mar 1973).

Utilizing data of various workers, a simplified model of a generalized trabecular marrow space is suggested consisting of the sinusoidal blood volume represented by a sphere centered within

a larger sphere of marrow encased in a shell of compact bone. Using this model as a basis of calculation, the excess dose for various incident photon energies for several fractions of sinusoidal blood volume in the total blood volume were determined and are shown. From these curves it is seen that the assumption of a sinusoidal blood volume within the marrow space results in a dose to the hematopoietic tissue that is greater than that expected from previous work that ignored the partial filling of the soft-tissue space by variable volumes of circulatory blood contained within the marrow sinusoids. (UK)

27966 CHANGES IN THE SPLEEN CAUSED BY EXPERIMENTAL FRACTIONATED LOCAL X-IRRADIATION. Kovacs, L. (Hungarian Academy of Sciences, Budapest). Acta Morphol. Acad. Sci. Hung.; 20: No. 1-2, 1-12(1971).

The spleen of white rats was subjected to percutaneous x irradiation in 16 fractions, with a total of 8000 R. The changes were studied by histological and histochemical methods 1, 3, 5, 7, 10, 15, 50, 100, and 150 days after the last irradiation. According to the results obtained, the alterations can be divided into three periods. On the first period (1 to 3 days), the lymphocytes fail to be detectable in the organ, only reticular cells containing large amount of hemosiderin reveal an increased activity. In the second period (5 to 15 days), regeneration of the lymphocytes starts from the reticular cells and from the circulation. In the third period, the hyperplasia of the connective tissue and the damage to the vessel walls increasing slowly up to the 150th day lead to a gradual decrease of the number of lymphocytes. No pathological alteration can be found in the reticular cells. (auth)

27967 ANALYSIS OF BEHAVIORAL FACTORS AND THEIR RELATIONS TO RADIOSENSITIVITY. Di Paola, M. (CNEN, Rome). Med. Nucl.-Radiobiol. Lat., Suppl.; No. 3, 376-379(1968). (In Italian). (RT/BIO-72-21).

In previous experiments, correlations between the radiosensitivity and the behavior response in mammals were observed. These relations are manifestations of the nervous system influence on the pathogenesis of radiation disease and they result from individual differences in emotion (reactivity) and in general activity (undifferentiated level of arousal). These relations were postulated to change with the radiations dose and the modality of exposure. The extent of the influence of the nervous system characteristics activity on the radiosensitivity was analyzed at different doses of radiation. Five hundred and forty six rats were classified individually on the basis of the learning ability, emotional behavior, and volitional activity before they were irradiated to assess their radiosensitivity (lethality at 30 days). Behavioral factors were identified by the inter-correlation matrix and the factorial analyses. Thus it was possible to distinguish two groups of behavioral variables: one mainly containing the emotional factor, the other one containing the factor of learning and general activity. The rats of each experiment were distributed according to the value of each variable. The radiosensitivities of the two groups separated by the median were compared. (auth)

27968 EFFECTS OF GAMMA RADIATION ON THE SHARK BRAIN. Olsson, Y.; Carsten, A. L.; Klatzo, I. (National Institutes of Health, Bethesda, MD). Acta Neuropathol.; 21: 1-10 (1972).

A comparison was made between the effects of gamma radiation on the elasmobranch and the mammalian brain. Thirty-seven nurse sharks (Ginglymostoma cirratum) received a single exposure, in a range of 1,000 to 30,000 rads, to the brain. The animals remained seemingly unaffected in their behavior and at their sacrifice, between one day and 12 months after irradiation, no histological changes could be detected with the exception of one shark (exposed to 30,000 and sacrificed after 12 months) that showed two small necrotic lesions in the tegmentum. No detectable difference in amount and distribution of glycogen on the brain could be demonstrated between irradiated and non-irradiated sharks. Also, irradiated sharks showed no changes of the blood-brain barrier to protein tracer. Rats irradiated with 25,000 to 30,000 rads to the brain from the same source died shortly after exposure or showed extensive necrotic lesions in the brain. There was also an intense accumulation of glycogen mostly in the astrocytes and a widespread disturbance of the blood-brain barrier to Evans Blue-albumin tracer. (auth)

27969 EFFECT OF GAMMA RAYS ON ACTIVE IMMUNITY DEVELOPMENT AFTER THE IRRADIATION OF GUINEA PIGS. Todorovic, S. Mikrobiologija; 7: No. 2, 231-238(1970). (In Bulgarian).

The influence of gamma rays (100 R to 400 R) on the active immunity was examined. Thirty and 3 days after vaccination with tetanus anatoxin guinea pigs were irradiated with 100, 150, 200, 250, 300, or 400 R. (Bull. Sci., Sect. A Sci. Nat. Tech. and Med.)

27970 DYNAMICS OF CHANGES OCCURRING IN THE MUCOPOLYSACCHARIDES AND PROTEINS OF THE KIDNEYS OF IRRADIATED RATS. Olinic, A. Cluj. Med.; 44: No. 3, 647-652 (1971). (In Rumanian).

Rats were irradiated with a single or fractioned sublethal dose of x rays (800 R). The kidneys were removed at various intervals and the changes occurring in mucopolysaccharides and proteins were studied by histochemical methods. The changes found illustrate destructive and regenerative phenomena occurring in radiation nephritis. The degree of the histochemical changes was dependent upon the way in which the x-ray dose was fractioned. (auth)

27971 BONE MARROW AND LYMPH NODE CHANGES IN IRRADIATED AND SPLENECTOMIZED RATS. Papilian, V. V. Cluj. Med.; 44: No. 3, 635-642(1971). (In Rumanian).

A comparative study was made of the effects of a whole-body dose of 400 R x radiation administered in fractionated doses on intact and splenectomized rats. In the intact animals irradiation caused progressive irreversible changes in the lymph nodes, partially reversible changes in the bone marrow, and fibrous atrophy of the spleen. The death rate of the animals was 61.1%. In splenectomized rats the death rate was 12.5% and changes in bone marrow and lymph nodes were less severe. Effects on the liver of splenectomized rats were unfavorable. (HLW)

27972 INFLUENCE OF X-RADIOGRAPHY AND ANESTHESIA ON WEIGHT GAIN AND SKULL GROWTH IN THE RAT. Vilmann, H. (Royal Dental Coll., Copenhagen). Arch. Oral Biol.; 18: No. 1, 141-143(Jan 1973).

Normal weight gain of rats subjected to frequent anaesthesia and x radiography was slightly depressed. However, no influence of these mild stresses was found on the growth of the skull. (auth)

27973 RADIATION DAMAGE OF LIVING CELLS. Kondratenko, W. Ideen Exakten Wissens; No. 8, 499-502(1972). (In German).

There can be no doubt that severe biological radiation damage is due to the destruction of unique molecules or structures. The problem is, however, that in most bases these damaged molecules are very difficult to localize. This is why the study of early radiation effects is of particular importance, the luminescence method being one of the most suitable procedures for this purpose, especially for investigating the cell nuclei. Results of studies of fish embryos carried out with this method are discussed. (GF)

27974 FLUORESCENCE MICROSCOPIC STUDY OF THE EFFECTS OF X RAYS ON ASCITES TUMOR CELLS. Raimondi, L.; Basso Ricci, L. (Univ., Pavia, Italy). Boll. Soc. Ital. Biol. Sper.; 47: No. 9, 247-248(1971). (In Italian).

Following development of Yoshida ascites hepatoma in rats and Ehrlich adenocarcinoma in mice, one half of the animals were x-irradiated. Tumor cells were removed and treated with acridine orange, rhodamine B, berberine sulfatex, and tetracycline. Irradiation decreased the fluorescence of the tumor cells. (HLW)

27975 RADIOPROTECTING EFFECTIVENESS OF THREE HETEROCYCLIC NITROGEN COMPOUNDS ON C3H MICE IRRADIATED WITH ^{60}Co. Mourret, A.; Agnius-Delord, C.; Rinaldi, R. (Univ., Grenoble, France). Compt. Rend., Ser. D; 275: No. 14, 1575-1578(2 Oct 1972). (In French).

The radioprotecting effectiveness of three heterocyclic nitrogen compounds (imidazole, benzimidazole, and naphazoline) on C3H/He/Orl mice (both sexes) exposed to a lethal dose of x rays was previously studied. In the present study, animals treated with these three products were exposed to γ radiation. The different behaviors with respect to the two radiations were studied as a function of the sex of the animals, the 100/30 day lethal dose, the survival characteristics, and the dose reducing factors. (France)

27976 SENSITIVITY OF IRRADIATED AND NORMAL BONE MARROW TO H.2 ANTISERUM. Haot, J. (Univ., Liege); Hiesche, K.; Revesz, L. Beitr. Pathol.; 147: No. 3, 213-220 (1972).

Incubation with H.2 antiserum, produced in C_{57}Bl mice by injection of spleen and lymph node cells from adult CBA mice, in dilutions up to $\frac{1}{8}$ killed about 30% of nucleated bone marrow cells from unirradiated mice of the CBA strain. About 60% of the population was killed when the bone marrow cells were obtained from mice preirradiated with 400 R x rays 12 days earlier, and contained lymphoid-like X-cells in a large proportion. Electronic volume measurements indicated that the killed cells had a volume up to about 200 μ^3, and that more cells in the range 150 to 200 μ^3 were destroyed from irradiated than unirradiated marrow. In myelograms, the antiserum sensitive cells were recognized as belonging to the lymphoid group. Antiserum abolished the spleen colony forming ability of both the irradiated and unirradiated marrow cells. The data support the assumption that bone marrow stem

cells belong to the lymphoid group, and that lymphoid-like X-cells which accumulate in the bone marrow of mice recovering from sublethal radiation damage, cannot act as stem cells. (GF)

27977 EFFECT OF CONTINUOUS IRRADIATION ON HAEMATOLOGICAL CHANGES IN RATS. Chlebovsky, O.; Praslicka, M. (Safarik Univ., Kosice, Czech.). Biologia (Bratislava); 26: No. 9, 653-663(1971). (In German).

Changes were studied in the peripheral blood count in rats, resulting from continuous irradiation from a ^{60}Co source with daily rates of 0.13 to 1680 R on an open gamma field. After exposure of up to 1.8 R/d no changes or only a slight increase in the granulocyte count were observed. Exposure rates of between 4.2 and 10 R/d resulted in decreased granulocyte values. The values later increased showing a peak on the 140th day after exposure. Exposure rates of 27 to 60 R resulted in a steady state in 25 to 30% of experimental animals, as compared with the controls. Higher rates resulted in a rapid increase in granulocytes which later slowed down and lasted until the death of the animals. An increased number of granulocytes could be observed after exposure rates between 0.26 R/d and 67 R/d. A decreased count of granulocytes was observed after doses of between 90 and 184 R/d, while an increase was found on the 2nd day of irradiation, which is typical of acute exposure. After a rate of 27 R a temporary decrease in the erythrocyte count was found; a permanent decrease, however, resulted from doses exceeding 90 R/d. (NSA of Czech.)

27978 UPTAKE OF GLUCOSE-^{3}H BY GLIA CELLS BEFORE AND AFTER RADIATION INJURY (X-RAYS AND 14 MeV NEUTRONS). Lierse, W. (Univ. Hamburg). Virchows Arch., B; 11: No. 4, 326-333(1972).

Effects of single doses of x rays and 14-MeV neutrons on the adult guinea-pig brain were studied by light microscopy and autoradiography. The importance of labeled glucose on glial metabolism and the damage caused by irradiation is described. After exposure to irradiation the incorporation of glucose-^{3}H and its metabolites is not blocked only in glial cells, which are filled with glycogen and glycoproteins. The 14-MeV neutrons damage glial cells in the same manner as x rays, γ rays, fast electrons, or α particles. All kinds of glial cells, astrocytes, oligodendrocytes, ependymal cells, and Müller's cells in the retina, are injured. The cells of the white matter in the cerebrum and cerebellum are more sensitive to irradiation than those in fiber tracts of the basal-ganglia and thalamus. (auth)

27979 EFFECT OF HYPOXIC HYPOTHERMIA ON THE FORMATION OF ENDOGENOUS SPLEEN COLONIES IN IRRADIATED MICE. Kalina, I.; Marko, L.; Praslicka, M. (Safarik Univ., Kosice, Czech.). Biologia (Bratislava); 26: No. 6, 469-475(1971). (In German).

The effect of prolonged hypoxic hypothermia, applied immediately after irradiation, on the formation of endogenous spleen colonies was studied in irradiated mice. For all doses, the maximum formation of endogenous spleen colonies occurred when hypoxic hypothermia had lasted 12 hours. The stimulating effect of a 6-hour-long hypoxic hypothermia was weaker. Temperatures of 20 and 16°C were found more favorable to the formation of the colonies than a temperature of 25°C. (NSA of Czech.)

27980 MORPHOLOGICAL CHANGES IN THE SPLEEN OF IRRADIATED MICE NINE DAYS AFTER THE TRANSPLANTATION OF HOMOLOGOUS BONE MARROW. Viktora, L. (Inst. of Haematology and Blood Transfusion, Prague). Folia Morphol. (Prague); 19: No. 2, 182-186(1971).

The state of haematopoiesis in the spleen and the participation of the individual blood components was studied in lethally irradiated mice nine days after the transplantation of preserved, fresh, homologous bone marrow. It was found that erythropoiesis played the major part, and that granulocytopoiesis also participated significantly, in the regeneration of haematopoiesis at this stage. (NSA of Czech.)

27981 INFLUENCE OF AET ON SOME IMMUNOLOGICAL PROCESSES IN RABBITS IRRADIATED WITH ^{60}Co. Gidaly, M.; Gorgan, V.; Balcea, M.; Uray, Z.; Dancescu, M.; Bolan, T. Cluj. Med.; 44: No. 3, 631-634(1971). (In Rumanian).

The protective effect of AET on the immunological reactions in ^{60}Co irradiated rabbits immunized with Salmonella typhimurium vaccine was studied. Ten minutes after introducing AET, the rabbits were irradiated, and after 12 hours inoculated with the vaccine in three repeated doses. AET does not inhibit the immunodepressive action of semi-lethal doses on the agglutinin synthesis. AET has a strong radioprotective action on the phagocytosis. (auth)

27982 EFFECT OF CONTINUOUS OR FRACTIONATED IRRADIATION ON A MURINE SARCOMA. Hill, R. P.; Bush, R. S. (Ontario Cancer Inst., Toronto). Brit. J. Radiol.; 46: No. 543, 167-174(Mar 1973).

The effect on a transplantable mouse tumour (KHT sarcoma) of irradiation (^{60}Co γ-radiation) at three different continuous low dose rates (41, 175, and 800 rads/hour) and one fractionated radiation regime (470 rad fractions every three hours) was investigated. The response of the tumours was measured by determining dose-survival curves for the cells of the tumour using a lung colony assay method. In all cases, the survival curves were found to be the same and quite similar to the one obtained for single acute doses (100 rads/minute). These findings were further investigated by giving acute irradiation (aerobic or anoxic) immediately following a dose of continuous irradiation. The results indicated that even after 3,000 rads of low dose-rate irradiation, the tumours still contain surviving well oxygenated cells. It is suggested that the most likely explanation for the results obtained at the different dose-rates is that reoxygenation occurs during the irradiation and that the sensitizing effect of this reoxygenation is balanced out by repair of the radiation damage. The findings of almost no dose-rate effect for the tumours were in contrast to the known effect of low dose rate irradiation on normal tissue and well oxygenated cells in vitro. (auth)

27983 INFLUENCE OF IONIZING RADIATION ON THE TOOTH ORGAN. Klimek, H. (Wojskowy Instytut Medycyny Lotniczej, Warsaw). Postepy Astron.; 5: No. 1, 43-64(1972). (In Polish).

Changes in tissues surrounding teeth during acute radiation sickness are described on the basis of clinical observations and histopathological studies. Histological studies of experimental animals indicate that irradiation produces changes in the ligament apparatus of the teeth. Observed differences in post-irradiation pathological changes in different rats of the same experimental groups are explained to individual differences in the resistance and sensitivity of the animals. (International Aerospace Abstracts)

Invertebrates

Refer also to abstracts 27608 and 27868.

27984 (AEC-tr-7415, pp 175-178) VIABILITY OF PROGENY OF IRRADIATED PARAMECIA DURING VEGETATIVE REPRODUCTION AND AFTER CONJUGATION. Bychkovskaya, I. B.; Ochinskaya, G. K. (Central Scientific-Research Inst. of Roentgeno-Radiology, Leningrad). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 767-770(1972).

In the progeny of x-irradiated infusoria (P. caudatum), in the case of their vegetative reproduction for an indefinitely long period, a certain constant level of death of the cells is established. After the sexual process, this level is sharply increased for some time (~12 days), but then returns to the level that prevailed before conjugation. The effect in the dose range from 0.5 to 40 kR does not depend on the dose of radiation and the time elapsed after irradiation. (tr-auth)

27985 TRANSLOCATION HOMOZYGOTES IN THE YELLOW FEVER MOSQUITO, AEDES AEGYPTI. Lorimer, N.; Hallinan, E.; Rai, K. S. (Univ. of Notre Dame, IN). J. Hered.; 63: 158-166(1972).

Two reciprocal translocation homozygotes, one sex-linked, involving chromosomes 1 and 3 and the other autosomal, involving chromosomes 2 and 3 were isolated and identified in Aedes aegypti on the basis of egg hatch, genetic analysis, and cytological evidence. Detailed cytogenetic analysis undertaken in a vector species is reported. The potential of these homozygotes for population control and/or replacement of mosquito populations is discussed. (auth)

27986 INDUCED DOMINANT LETHALS IN THE IMMATURE STAGES OF CULEX PIPIENS MOLESTUS FORSK BY GAMMA IRRADIATION. Abdel-Malek, A. A.; Ahmed, S. H. (Univ. of Cairo). Egypt. J. Genet. Cytol.; 1: No. 2, 300-302(Jun 1972).

Pupae of Culex pipiens molestus were subjected to various doses of gamma radiation from a ^{60}Co source and the percentages of dominant lethals in the eggs, larvae, and pupae of the next generation were determined. The results are shown by means of a graph. The dominant lethality was greatest in the egg stage and least in the pupal stage. (HLW)

27987 SCREENING BY PARTHENOGENESIS FOR INDUCED MUTATIONS IN DROSOPHILA MERCATORUM. Carson, H. L.; Snyder, S. H. (Univ. of Hawaii, Honolulu). Egypt. J. Genet. Cytol.; 1: No. 2, 256-261(Jun 1972).

A method for screening x-ray-induced mutations in D. mercatorum is described. Treated males were mated to females from a high-parthenogenesis strain. Virgin daughters of each male, carrying the new mutants in heterozygous state, were allowed to reproduce parthenogenetically. Because of the high frequency of diploidization by doubling of a single haploid meiotic product, new recessive mutations appeared directly in the homo-

zygous condition in the impaternate females so produced. From 18 treated males, 5 new recessive visible mutations were obtained. (auth)

27988 BIOLOGICAL PEST CONTROL. Franz, J. M.; Krieg, A. Berlin; Parey (1972). 208p. (In German).

The chapter on "autocidal control" deals with the sterilization of pests by ionizing radiation. The sources currently used for this purpose are ^{60}Co and ^{137}Cs and the sterilizing dose usually applied lies between 2 and 40 KR. Field experiments with pests sterilized by this method led to a first success in 1955. Another successful experiment carried out in the United States where the screwworm was brought under control by this technique is briefly reviewed along with other examples. (GF)

27989 GYPSY MOTH STERILIZATION WITH ^{60}Co γ RADIATION. Vasiljevic, L. J. Zast. Bilja; 21: No. 109, 201-206(1970).

Gypsy moth pupae were γ-irradiated (^{60}Co) at doses of 1,000 to 60,000 R at a dose rate of 9,000 R per hr. The exposures resulted in the total sterilization of both male and female moths. (Bull. Sci., Sect. A.)

27990 STUDIES ON THE RICE STEM BORER CONTROL USING STERILE-MALE TECHNIQUE. I. On the Radiosensitivity of Rice Stem Borer (Chilo suppressalis Walker). Chung, K. H.; Ryu, J. Han'guk Sikmul Poho Hakhoe Chi; 10: No. 2, 117-120 (1971).

This experiment was carried out to obtain basic information on the development in sterile-male technique of rice stem borer. The species considered is Chilo suppressalis Walker. Different developmental stages of the insect namely; larvae, pupae, and adult were irradiated with ^{60}Co gamma rays. The results obtained were as follows: A 1:1 sex ratio in the pupal stage was observed. In the pupal stage, sub-lethal dosages (LD_{50}) were 26 kR and 26.7 kR for female and male, respectively. The total number of egg masses per female increased with the increasing gamma ray dosages and average number of eggs produced per female decreased in the cross between normal female and irradiated male. The sterile dosage (SD_{99}) of the gamma ray irradiation showed 23 kR in the male. The pupal stage is most convenient developmental stage for irradiation. (Korean Sci. Abstr.)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 27577 and 27894.

27991 (BRH-DEP-73-3, pp 173-179) RADIATION SAFETY WITH ISOTOPES. Richardson, H. D. (Louisiana State Univ., Baton Rouge, LA). Oct 1972.

In radiation safety and protection in industrial applications.

The radiation hazards to industrial personnel using radioisotopes are related to the characteristics of the isotope such as decay energy, physical half-life, biological half-life, chemical form, and the site deposited in the body. The most obvious safety measure is to prevent the radioisotope from entering the body. The training of personnel in appropriate radiation protection procedures to prevent injury to himself and to assure there is no excessive exposure of other human beings is stressed. (CH)

27992 (CONF-720818-, pp 1-16) THEORETICAL COMPARISONS OF DOSAGE FROM ^{90}Sr AND ^{226}Ra IN HUMAN AND BEAGLE BONE. Spiers, F. W.; Whitwell, J. R. (Univ. of Leeds, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

Theoretical methods were developed to determine the absorbed dose to tissues in bone on the basis of measurements of trabecular bone dimensions made with an object-plane scanning microscope. Calculations were made of the absorbed dose averaged over the active marrow in trabecular bone, averaged over endosteal cells that lie between 0 and 10 μm from the trabecular surfaces, and averaged over cells lying between 0 and 10 μm from the surfaces of Haversian canals and resorption cavities in cortical bone. Comparisons are made between these dose parameters for ^{90}Sr in human adult, human child, and beagle bone. Similar calculations are made for ^{226}Ra. The results are shown to be relevant to considerations of the relative toxicity of ^{90}Sr and ^{226}Ra in man and in the beagle. (auth)

27993 (CONF-720818-, pp 181-206) PREDICTED TOXICITY OF ^{90}Sr IN HUMANS. Mays, C. W.; Lloyd, R. D. (Univ. of Utah, Salt Lake City). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The risk to humans from ^{90}Sr-induced skeletal cancers was estimated by adjusting the risk from radium in the human skeleton by the RBE of ^{90}Sr vs ^{226}Ra established in experimental animals. The risk to humans from ^{90}Sr-induced leukemias was estimated by adjusting the risk to the A-bomb survivors by the RBE at low vs high dose rates established in experimental animals, and by the ratio of marrow/skeletal doses from ^{90}Sr. Lifespan risks from induced fatal malignancies (skeletal cancers plus leukemias) were estimated for doses below 1000 rads. (MCG)

27994 RADIATION BURDEN IN PLACENTOGRAPHY WITH ^{113m}In. Leven, H.; Wuerthner, K. (Univ., Hamburg). Nucl.-Med., Suppl.; No. 9 Suppl., 416-423(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

From excretion measurements and from measurement of placental transfer for the isotope ^{113m}In, the radiation burdens of mother and fetus were determined which result from placentography with ^{113m}In. The mean dose of the mother amounted to 19 mrad, of the maternal blood: 83 mrad, and of the fetus, 8 mrad. The radiation burden of the fetus is negligibly small in comparison with the recommended I.C.R.P. value for maximal fetal burden. (1 rad). (tr-auth)

27995 ACUTE ACCIDENTAL RADIODERMATITIS. Mestdagh, C.; Simon, S.; Simonart, J. M. (Institut Medico Chirugical, Ixelles, Belg.). Arch. Belg. Dermatol. Syphiligr.; 24: No. 1, 73-75(1968). (In French).

An accident occurring to a workman regularly manipulating sources of ^{192}Ir is reported. The patient developed vesicular lesions on the palm side of the three first fingers of the left hand. By the third month the cicatricial skin was atrophied. Repeated questionings elicited that fact that the patient had manipulated with his bare hand a carrier containing ^{192}Ir. The therapy used is described. (JSR)

Animals

Refer also to abstracts 27929, 27944-27946, and 28050.

27996 (AEC-tr-7415, pp 74-81) EFFECTS OF INCORPORATED RADIOPHOSPHORUS ON THE HIGHER NERVOUS ACTIVITY OF DOGS IN THE CASE OF ITS REPEATED ADMINISTRATION AT AN EARLY AGE. Chervinskaya, A. F. (State Univ., Rostov-on Don, USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 688-693(1972).

From the age of 5 weeks, puppies received radiophosphorus (^{32}P) with their food twice a month for a period of a year in doses of 10 and 20 μCi/kg each time. Stable changes in the conditioned reflex activity were detected in the animals in the form of different degrees of weakening of the basic nervous processes, disturbances of their equilibration, and a deterioration of mobility, detected in most of the dogs in the absence of clinical and hematological disorders. Part of the animals developed leukemia in the long-term periods after irradiation. (tr-auth)

27997 (AEC-tr-7415, pp 125-130) COMPARATIVE BIOLOGICAL EFFECTIVENESS OF ^{152}Eu AND ^{244}Cm. Moskalev, Yu. I.; Zalikin, G. A.; Stepanov, V. S.; Semenov, A. I. (Inst. of Biophysics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 730-734(1972).

An investigation of the biological effects of europium-152 and curium-244, which are monotypically distributed in the organism, but possess different types of radiation, was conducted on rats. According to the criterion of lifetime, the response of the leukocytes and lymphocytes, the α emitter curium-244 is an average of 10 times as effective as europium-152, which possesses mixed $\beta-\gamma$ radiation. (tr-auth)

27998 (AEC-tr-7415, pp 205-209) EFFECTS OF SUBACUTE EFFECTIVE DOSES OF ^{241}Am ON RABBITS. Rudnitskaya, E. I.; Moskalev, Yu. I. (Inst. of Biophysics, Moscow). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 788-791(1972).

In the case of a single intravenous injection of ^{241}Am chloride in doses of 10, 20, and 30 μCi/kg, rabbits develop a subacute form of radiation sickness with predominant lesion of the organs of hematogenesis and liver. Liver lesion is of vital significance in thanatogenesis. A correlation is detected between the period of death of the animals and the amount of activity introduced. A relationship was established between an iron-containing pigment in the organs of hematogenesis and liver and aggregated particles of the substance. (auth)

27999 (AEC-tr-7418, pp 16-30) DEVELOPMENT OF ATLANTIC SALMON EGGS UNDER CONDITIONS OF RADIOACTIVE CONTAMINATION OF WATER BY $^{90}Sr-^{90}Y$ AND ^{144}Ce. Migalovskii, I. P. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanorg.; No. 29, 16-27 (1971).

A study was made of the effect of radioactive isotopes $^{90}Sr + ^{90}Y$ ($5 \cdot 10^{-6}$ curie/liter, $5 \cdot 10^{-8}$ curie/liter, $5 \cdot 10^{-10}$ curie/liter) and ^{144}Ce ($3 \cdot 10^{-6}$ curie/liter, $3 \cdot 10^{-8}$ curie/liter, $3 \cdot 10^{-9}$ curie/liter) on the embryonal development of the Atlantic salmon (Salmo Salar L.). The action of the isotopes is manifested in lengthening of the hatching period, appearance of deformed embryos and larvae, in an increased death of eggs and larvae; for ^{144}Ce it begins with a radioactivity level $3 \cdot 10^{-9}$ curie/liter and for $^{90}Sr + ^{90}Y$ it begins with $5 \cdot 10^{-10}$ curie/liter. In addition, at all ^{144}Ce radioactivity levels up to the stage of onset of gastrulation there is an increased development rate. The dependence of the types of deformities on the specific action of the isotopes was established. (auth)

28000 (AEC-tr-7418, pp 31-35) DATA ON THE DEPENDENCE OF DOSE EFFECT FOR EGGS OF ATLANTIC SALMON. Polymakhin, V. N. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 28-31 (1971).

A study was made of the dependence of the observed radiobiological effects on dose magnitude. As indices of the radiobiological effect the mortality of the embryos and larvae and the number of anomalous larvae were used. The dose-effect curves show that the magnitude of the radiobiological effect of beta-radiation for the considered indices is determined by the properties of the radioisotope whose influence was investigated. Results are reported for ^{144}Ce, ^{144}Pr, ^{90}Sr, ^{90}Y, and ^{137}Cs. (HLW)

28001 (AEC-tr-7418, pp 36-52) DEVELOPMENT OF FISH EGGS AND THE EARLY PERIOD OF GAMETOGENESIS IN THE EMBRYOS AND LARVAE OF THE ATLANTIC SALMON UNDER CONDITIONS OF RADIOACTIVE CONTAMINATION OF WATER. Migalovskii, I. P. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 32-44(1971).

Three activity levels of $^{90}Sr + ^{90}Y$: $2 \cdot 10^{-5}$, $0.7 \cdot 10^{-6}$, and $0.6 \cdot 10^{-7}$ curie/liter were used. The article examines stages in development of eggs of the Atlantic salmon prior to closing of the blastopore, formation of the tail kidney, yolk-vitelline circulation and one-day larvae. There was no difference between the control and experimental variants with respect to duration of individual development stages and the length of embryos and larvae. In addition, at the mentioned development times the author computed the number of primary sex cells (PSC) in control and experimental variants. There was a depression in the process of formation of PSC for the experimental variant with an activity of $2 \cdot 10^{-5}$ curie/liter, whereas the number of PSC in the experimental variant with an activity of $0.7 \cdot 10^{-6}$ curie/liter approaches their number in the control and in the variant with $0.6 \cdot 10^{-7}$ curie/liter the number somewhat exceeds the control. (auth)

28002 (AEC-tr-7418, pp 66-74) EFFECT OF $^{90}Sr + ^{90}Y$ ON THE DEVELOPMENT AND FUNCTIONING OF THE HATCHING GLANDS IN ATLANTIC SALMON. Kasatkina, S. V. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 55-61(1971).

A study was made of the morphophysiological state of the hatching glands in embryos developing under conditions of chronic contamination of water by $^{90}Sr + ^{90}Y$ ($2 \cdot 10^{-5}$, $0.7 \cdot 10^{-6}$, $0.6 \cdot 10^{-7}$ curie/liter) and also with a combined exposure $^{90}Sr + ^{90}Y$ $2 \cdot 10^{-5}$ curie/liter + 350 R). No changes in morphology of the hatching glands were discovered in a study of histologic specimens of the head part of experimental embryos. In all the experimental variants the action of the radioisotopes $^{90}Sr + ^{90}Y$ causes a more intensive enzyme accumulation by the hatching glands, whereas in variants with an activity of $2 \cdot 10^{-5}$, $0.7 \cdot 10^{-6}$, and $0.6 \cdot 10^{-7}$ curie/liter it leads to earlier onset of hatching in comparison with the control. With a combined exposure of the Atlantic salmon embryo the process of enzyme secretion by the hatching glands is slowed down; this can probably be attributed to the aftereffect of x irradiation. (auth)

28003 (AEC-tr-7418, pp 89-99) CHRONIC EFFECT OF $^{90}Sr + ^{90}Y$ ON THE FREQUENCY OF CHROMOSOMAL ABERRATIONS IN THE EMBRYONAL CELLS OF THE ATLANTIC SALMON. Migalovskaya, V. N. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 74-81 (1971).

Three radioactivity levels for $^{90}Sr + ^{90}Y$ were used: $2 \cdot 10^{-5}$ curie/liter, $0.7 \cdot 10^{-6}$ curie/liter and $0.6 \cdot 10^{-7}$ curie/liter. Developing embryos of the Atlantic salmon were investigated in the stages of the blastomeric and epithelial blastula, gastrula, and also at the age of one-day larvae. The criteria for the radiation effects were the mitotic index and the frequency of chromosomal aberrations. Temporary specimens stained with acetocarmine were investigated. No decrease in the percentage of dividing cells was detected in the investigated development stages. In variants with a radioactivity level $2 \cdot 10^{-5}$ curie/liter and in a combined exposure there was a reliable increase in the frequency of chromosomal aberrations, beginning with the epithelial blastula stage. A great diversity of types of chromosomal aberrations was noted: individual bridges, fragments, multiple bridges, presence in the cell of several fragments, multipolar mitoses, and formation of micronuclei. (auth)

28004 (AEC-tr-7418, pp 113-133) RADIOMETRIC AND DOSIMETRIC CHARACTERISTICS OF EXPERIMENTS FOR DETERMINING THE INFLUENCE OF RADIOACTIVITY OF A WATER MEDIUM ON THE DEVELOPMENT OF EGGS OF THE ATLANTIC SALMON. Podymakhin, V. N. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 91-103(1971).

A detailed study was made of the methodological characteristics and specific results of measurements of the radioactivity of the eggs (and their individual components) of the Atlantic salmon. The material was obtained in an experiment with the incubation of eggs in aquaria with water contamination by $^{90}Sr + ^{90}Y$, $^{144}Ce + ^{144}Pr$, and ^{137}Cs at the Ura-Guba Fish Hatchery during the period from October 1966 through June 1967. On the basis of radiometric data the author determined the absolute values of some characteristics of the natural dose fields and radiation loads on eggs in aquaria with radioactive contamination of the water. These load values determine the degree of the radiobiological effect of the isotopes in the water on the fish eggs. (auth)

28005 (AEC-tr-7418, pp 142-156) NATURAL RADIATION LOADS ON THE EGGS OF MARINE AND FRESH EATER ORGANISMS. Podymakhin, V. N. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 116-127(1971).

An approximate method for computing the energy of beta radiation absorbed by eggs under different natural conditions with allowance for the geometric peculiarities of the object is described. Using the derived expressions the absolute values of the radiation loads from the natural radioactive isotopes present in sea and fresh water were computed. The derived formulas can also be used for computing the doses from artificial radionuclides. (auth)

28006 (AEC-tr-7418, pp 157-165) EFFECT OF INCORPORATED RADIONUCLIDES ON THE CHROMOSOMAL APPARATUS OF MARINE FISH. Tsytsugina, V. G. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 128-134(1971).

The fertilized eggs of Scorpaena porcus L. and Rhombus maeoticus Pall. were incubated in solutions of radionuclides strontium-90 + yttrium-90, strontium-89 and yttrium-91 in the range of concentrations 10^{-11} to 10^{-5} curie/liter. In the gastrula and one-day prolarva stages the material was fixed and pressed acetoorcein specimens were prepared. Anaphases and telophases with chromosomal impairments were detected. A high radiosensitivity of the embryos of marine fish was noted: a reliable damaging effect was already noted in concentrations of radionuclides 10^{-10} curie/liter to 10^{-5} curie/liter. There was a close correlation between the degree of chromosomal damage and the gravity of radiation damage to prolarvae. (auth)

28007 (CONF-720818-, pp 17-30) QUANTITATION OF ^{90}Sr TOXICITY IN DOGS. Goldman, M.; Pool, R.; Momeni, M. H.; Wilson, F.; Williams, R. J. R.; Chrisp, C.; Rosenblatt, L. S.; Bustad, L. K. (Univ. of California, Davis). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

Exposure of dogs to graduated dose levels of ^{90}Sr continuously from mid-gestation to 1.5 yrs of age induces a spectrum of toxic effects. The most significant observations on Beagle dogs up to 11 yrs of age was the induction of myeloproliferative disorders including leukemia, and sarcomas and carcinomas in tissues in and adjacent to ^{90}Sr laden bone. Gross and local doses to skeleton and marrow were measured by whole-body counting and thermoluminescent dosimetry, respectively. In uniformly labeled dog bone, the average dose to marrow ($\bar{D}_m$) was about 0.6 that of the mineral bone (D_o) but varied as a function of local geometric factors, primarily that of the trabeculation pattern. Animals received from 20,000 mrad/day (fed 36 μCi/day) down to about 20 mrad/day to bone in seven exposed groups, each separated by a factor of three. The earliest indication of radiation injury was seen as a dose rate related neutropenia whose severity in-

creased with time but which showed some tendency to recovery when ^{90}Sr feeding is stopped. The latter finding correlates well with the drop in trabecular bone mineral ^{90}Sr content (and marrow dose). When marrow doses were in excess of 500 mrad/day, a dose and time related increase in fatal myeloproliferative disorders was seen, the earliest at about 1.4 yrs of age and signalled by a marked anemia. In these cases the cumulative dose to the skeleton was generally 1000 to 15,000 rad. The data were analyzed with respect to each major cause of death, morbidity, survival, and dose to provide a three-dimensional dose-time-response surface. The dose-response relationship was nonlinear and was used to extrapolate to very low levels of exposure. (auth)

28008 (CONF-720818-, pp 39-47) INVESTIGATION OF DOSES PRODUCED BY ^{90}Sr TAKING INTO ACCOUNT AGE-DEPENDENT BIOLOGICAL PARAMETERS: AN EXPERIMENTAL INVESTIGATION ON RATS. Borisova, V. V.; Zapol'skaya, N. A.; Shamov, V. P. (Inst. of Radiation Hygiene, Leningrad). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

In experiments on biological effects of bone-seeking isotopes (malignant neoplasms, lifespans, etc.), the quantitative determinations of absorbed dose and of dynamics of its production concern startling information without which it is hard to explain correctly the observable effect. Insofar as a number of biological parameters controlling the dynamics of dose production are changed essentially during the evolution of organism, it is necessary to develop such a model that should take this variation into account. The study was undertaken in attempt to solve the indicated problem concerning small experimental animals (strainless male rats). The experimental data on the metabolism of ^{90}Sr in rats for different modes of entry into animals of different ages were laid into the foundation of mathematical models describing the behavior of strontium in the body. (auth)

28009 (CONF-720818-, pp 67-78) THERMOLUMINESCENCE DOSIMETRY OF BETA EMITTERS IN BONE. Poll, V.; Beddoe, A. H.; Aspden, P. J.; King, S. D. (Medical Research Council, Leeds, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Methods are described in which fine-grain thermoluminescent powders are used to measure β dose to marrow in trabecular bone. Results are given for dose-rate measurements in beagle bones containing Sr-90 and in replicated human bone containing Ca-45, Tl-204, and P-32. These are compared with theoretically calculated dose rates. Finally, consideration is given to the radiation absorption properties of various thermoluminescent phosphors with respect to their suitability for use in bone-marrow dosimetry. (auth)

28010 (CONF-720818-, pp 155-166) COMBINED EFFECTS OF ^{131}I AND ^{90}Sr IN EXPERIMENTAL ANIMALS. Moskalev, Yu. I.; Strel'tsova, V. N.; Kalistratova, V. S. (Inst. of Biophysics, Moscow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The combined effects of ^{131}I and ^{90}Sr administered orally to rats at doses of 1 μCi/g and 0.5 μCi/g respectively were studied. The results indicate an essential contribution of ^{131}I to the changes of a number of metabolic indices (β-lipoproteins, total lipids, and serum cholesterol) observed at 14 days following combined administration. It was also observed that the osteosarcomagenic efficiency of ^{90}Sr was inhibited when administered in combination with ^{131}I. (ERB)

28011 (CONF-720818-, pp 167-172) TUMORS INDUCED BY ^{90}Sr IN NORMAL AND CHIMERIC CBA/H MICE. Bland, M. R.; Carr, T. E. F.; Loutit, J. F.; Sansom, J. M. (Medical Research Council, Harwell, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

In chimeras given strontium-90, fibrosarcomata (like osteosarcomata) arose from host cells, presumably skeletal connective tissue; lymphomas arose from donated myeloid cells. (auth)

28012 (CONF-720818-, pp 173-180) EVALUATION OF THE DANGER OF IMPAIRMENT TO THE HUMAN BODY FROM A CONSTANT INTAKE OF ^{90}Sr. Shvedov, V. L.; Panteleev, L. I.; Goloschapov, P. V. (Inst. of Biophysics, Moscow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The experiments were carried out on white rats of both sexes at the age of 3.5 to 4 months at the beginning of the experiment. The animals were divided into ten groups of 50 to 100 rats each. Males and females of nine experimental groups received strontium-90 orally every day within the entire duration of their life, the dose being 0.00005; 0.0005; 0.005; 0.05; 0.5; 1.0; 2.0; 4.0; and 5.0 mCi daily per animal. Initially osteosarcomas were revealed in 26% of rats, which received daily 0.5 mCi of Sr-90. The highest incidence of osteosarcomas (up to 42%) was revealed in the rats given 1.0 mCi of the isotope daily. Further increase of Sr-90 daily intake was accompanied by a decrease of bone tumor occurrence. Consequently the minimal Sr-90 daily intake that evoked the development of osteosarcoma was 0.5 daily. The dose rate to the critical organ was not more than 25 rads daily, the absorbed dose being between 5,000 and 8,000 rads. The development of osteosarcoma in man under exposure to radium-226 was recorded at a dose burden of not less than 1,000 rads. In those people, on whom critical organ dose burdens were less than the latter, bone tumors were not revealed within a 40-year period. The threshold dose value sufficient for the development of osteosarcoma in man in case of continuous, lasting all life Sr-90 intake may be considered not less than 3,000 to 5,000 rads, the dose rates being 60 to 100 rads a year. (auth)

28013 RESIDUAL TRITIUM ACTIVITY AFTER THE ADMINISTRATION OF TRITIATED THYMIDINE TO MICE. Mewissen, D. J.; Furedi, M.; Rust, J. H. (Univ., Brussels). Compt. Rend. Soc. Biol.; 166: No. 2, 465-467(1972). (In French).

The production of tritium and its release into the environment will increase considerably with the more widespread development of nuclear reactors. In view of such developments, studies were undertaken concerning the residual tritium activity in the organism of mammals after the administration of tritiated thymidine at birth. It was observed that newly born mice, having received an injection of thymidine, presented a permanent 3% residual activity. The dose delivered during the total survival period to the tissues and to the cell nuclei is small but not negligible. (France)

28014 INHIBITION OF URETHANE-INDUCED PULMONARY ADENOMAS BY INHALED ^{238}Pu. Brightwell, J.; Heppleston, A. G. (Univ. of Newcastle upon Tyne, Eng.). Brit. J. Radiol.; 46: No. 543, 180-182(Mar 1973).

Exposure of inbred mice belonging to an A strain to the inhalation of plutonium dioxide significantly inhibited the capacity of urethane to induce pulmonary adenomas, but tumour size was unaffected. Cell kinetic studies suggested that proliferation of cells comprising the adenomas diminished with time, though the decrease was less evident in irradiated than in nonirradiated animals. It is suggested that alpha irradiation may act by interfering with the immuno-depressive effect of urethane. (auth)

28015 EFFECT OF IRRADIATED WHEAT ON GERM CELLS IN MICE. Reddi, O. S.; Reddi Krishna, P. P.; Syamala, K.; Nair, P. (Osmania Univ., Hyderabad, India). Indian J. Med. Res.; 60: 1543-1546(10 Oct 1972).

Wheat exposed to 20,000 and 50,000 R was incorporated to the extent of 60% in the diet of mice fed over 180 days from the day of weaning, i.e., 28th day after birth. Gonadal cell survival and chromosomal aberrations at meiotic metaphase indicate no significant deviations from controls. (auth)

28016 EFFECT OF ^{90}Sr ON GONADAL CELL KINETICS IN MICE. Reddi, O. S.; Reddy, P. P.; Primila Rani, K.; Vijayalaxmi, C. (Osmania Univ., Hyderabad, India). Indian J. Anim. Sci.; 41: No. 5, 377-380(May 1971).

In both spermatogonia and oocytes the sensitivity increases steadily with the dose administered. A 2 μCi dose produced a cell-killing of about 47% of RPS, 34% of A and B spermatogonia, and 28% of primary and secondary oocytes. Further, an observed dominant lethality of 12.26% at 18 μCi given to males and 8.46% at 10 μCi given to females also confirmed the possible hazards of the use of ^{90}Sr in human medicine. (auth)

28017 GENETIC EFFECTS OF ^{90}Sr IN MICE. Reddi, O. S. (Osmania Univ., Hyderabad, India). Indian J. Anim. Sci.; 41: No. 1, 63-67(Jan 1971).

Strontium-90 in doses ranging from 0.1 to 25 μCi injected intraperitoneally into male mice caused an increased incidence of dominant lethality at all levels. A dose of 5 μCi caused an approximate doubling of the mutation rate in the population tested. There was a linear effect with lower doses up to 1 μCi, after which the effects leveled off. Strontium-90 caused breaks in the spermatids and spermatozoa in all doses; the spermatocytes were affected by the

higher doses only. The spermatids were the most sensitive cells found. Female offspring of ^{90}Sr-treated fathers when mated with normal males also showed dominant lethal effects. (auth)

28018 RADIOCYTOGENETIC STUDIES WITH ^{252}Cf. Bushong, S. C.; Prasad, N.; Briney, S. A.; Oliver, G. D. (Baylor Univ., Houston, TX). Int. J. Radiat. Biol.; 23: No. 2, 105-112(Feb 1973).

Chromosomal analysis of Chinese hamster ovary cells were conducted after irradiation with either radium or ^{252}Cf. Irradiations were performed at two different dose rates with each radiation source and under aerobic and anaerobic conditions. The OER was approximately 2.3 for radium and 1.8 for ^{252}Cf and was independent of dose rate. The RBE of ^{252}Cf compared with radium ranged from 1.7 to 4.3 depending on radiation conditions. (auth)

28019 TECHNIC FOR IMPLANTING A RADIOACTIVE PARTICLE IN A RODENT LUNG. Stanley, R. E.; Lloyd, S. R. (Western Environmental Research Lab., Las Vegas, NV). Lab. Anim. Sci.; 22: No. 3, 424-427(Jun 1972).

A simple and relatively atraumatic technic for implanting a single radioactive particle in the lung of rodents (hamsters and rats) is described. A small polyethylene cannula introduced in the trachea of an anesthetized rodent provides the passageway for insertion into the deep lung of a fine catheter containing a radioactive particle. Also described is the relative ease of implanting the particle in a particular lobe of the lung. In more than 300 hamsters (Mesocricetus auratus) successfully implanted, 77% were implanted in the intended lung lobe. Methods and devices used for animal restraint are also presented. (auth)

Plants

28020 RADIOSENSITIVITY OF THE LIVERWORT MARCHANTIA POLYMORPHA L. TO INTERNAL RADIOISOTOPES. Mache, R.; Patouraux, R. (Univ., Grenoble, France). Nature (London); 241: No. 5391, 547-548(23 Feb 1973).

Evidence is reported of the very great sensitivity of young Marchantia polymorpha plants to the internal radioisotopes ^{32}P and ^{35}S at concentrations usually used for labeling. At a ^{32}P concentration of 5 μCi/ml, the growth of thalli was greatly inhibited, and at 10 μCi/ml it was stopped. With ^{35}S, growth was stopped at 80 μCi/ml. As the energy of β particles from ^{35}S is about one tenth of that from ^{32}P it was concluded that comparable inhibiting effects occurred for equal energy flux. The nature of the element concerned is not involved in the inhibition. (UK)

Nuclide Kinetics and Toxicology

28021 (CONF-720818-, pp 255-272) STUDY ON PROTEIN-STRONTIUM BONDS. El Solh, N.; Rousselet, F.; Girard, M. L. (Laboratoire de Biochimie Appliquee, Paris). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The results suggest that the weak Sr-protein bond is indeed governed by the mass law relationship. The relevant association constant depends on the pH level and the phosphate concentration. At any pH, for any operating conditions (presence or lack of phosphate, varying quantities of Sr and Ca added independently or together at various concentrations), the concentration of protein-bound Sr in mM/g protein in always less than that of Ca: for instance, 10 μM Sr/g of protein and 16, 7 μM Ca/g of protein in similar conditions. When competition occurs for the common protein sites to which either one of the two cations can be bound, the calcium cations are favored. (auth)

28022 (CONF-720818-, pp 273-276) EFFECT OF THYROCALCITONIN (TCT) ON CALCIUM BINDING PROTEIN (CABP) AND STRONTIUM BINDING PROTEIN (SRBP). Menozel, J.; Mor, E. (Shaare Zedek Hospital, Jerusalem). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The protein isolated from the duodenal mucosa that was capable of binding calcium was found to bind strontium also. The specific activity of CaBP (31.36 counts/min per μg of protein) was similar to that of SrBP (32.44). Thyrocalcitonin (TCT) induced only a slight increase of Ca and SrBP. As to be expected vitamin D increased the specific activity of Ca and SrBP, and was further enhanced when TCT was injected together with vitamin D. (auth)

28023 PROCESS FOR THE ELIMINATION OF RADIOACTIVE IMPURITIES. Kudo, T. Belgian Patent 720,156. 30 Aug 1968. Priority date 10 Jan 1968, Japan.

A process is described for the elimination of radioactive impurities from foodstuffs or water characterized by the addition to them of a phosphorus compound (derived from seeds) as an absorbent and by the separation of this compound after agitation. (BE)

Man

Refer also to abstracts 27593, 27596, 27597, 27648, and 28083.

28024 (CONF-720818-) SECOND INTERNATIONAL CONFERENCE ON STRONTIUM METABOLISM, GLASGOW AND STRONTIAN, 16-19 AUGUST 1972. 1972. 588p. Dep. NTIS $6.00.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Separate abstracts were prepared for 44 of the 48 papers presented in this conference. Abstracts of the other four papers appeared in NSA as abstracts 48281 in volume 26 and 11983, 12354, and 15109 in volume 27. (ERB)

For abstracts of individual papers see: 27306, 27591-27597, 27992, 27993, 28007-28012, 28021, 28022, 28025-28035, 28047-28060, and 28073.

28025 (CONF-720818-, pp 91-110) WHOLE-BODY RETENTION OF ^{85}Sr IN THREE CHILDREN AGED 10 TO 11 YEARS. Woodard, H. Q.; Dwyer, A. J. (Sloan-Kettering Inst., New York, N.Y.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The whole-body retention of ^{85}Sr by three children was followed by external counting for 200 days after i.v. injection, during most of which time they were active and in good general health. The technical experimental error was not above ± 5%, but the initial whole-body retention (WBR) values may have been influenced by physiological stress. There was a 2-fold difference in the WBR of the three children at 40 days post injection, and a 3-fold spread at 200 days, with corresponding differences in radiation dose. The differences in the WBR values are highly significant statistically, and the fact that they persisted throughout the observation period indicates that they are not due primarily to early stress. There was a good positive correlation between WBR and rate of growth, and this in turn correlated with the pubertal status of the three children. Data are presented on the ^{85}Sr content of bone specimens obtained from these and other juveniles at various times after injection. There is a 10-fold spread in the values found. This can be correlated both with the type of normal bone, the age of the subject, and the time after injection. (auth)

28026 (CONF-720818-, pp 207-228) ALKALINE EARTH METABOLISM IN ADULT MAN: A CONDENSATION. Marshall, J. H. (Argonne National Lab., IL). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

A model based on products of power and exponential functions relates radioisotope retention to mechanisms: to bone formation, resorption, diffusion, and exchange in compact and cancellous bone, represents within 20% most existing microscopic and macroscopic data for stable or radioactive isotopes in healthy man, and facilitates calculations of dose to endosteal or marrow cells following any schedule of radioisotope intake. (auth)

28027 (CONF-720818-, pp 229-238) MATHEMATICAL MODEL OF ENDOCRINE REGULATION OF CALCIUM-STRONTIUM METABOLISM AND ITS EXPERIMENTAL STUDY. Lykhtarev, I. A.; Krasnostchekova, G. P. (Inst. of Radiation Hygiene, Leningrad). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

A mathematical model of endocrine regulation of calcium metabolism in human and rat bodies was built. The model includes a positive reaction of citric acid concentration on excess of parathyreocrine and a negative one- on a rise of calcitonine content in plasma. The citric acid in the intercellular space in the bone is regarded as a factor controlling the rate of secretion of calcium out of the bone into the plasma. Parathyreocrine, as assumed in the model influences directly the calcium clearance

of plasma. The content of calcium in the blood is the main regulation index of the rate of parathyreocrine and calcitonine secretion. Some characters of this model investigated on an analog computer were paralleled by the experiment on animals. The results confirmed the validity of the choice of the models structure and the coincidence of modes of reactions on an "instantaneous" injection of parathyreocrine and on prolonged parathyroidectomy. (auth)

28028 (CONF-720818-, pp 239-246) ANIMAL-MAN EXTRAPOLATION OF ^{90}Sr ACCUMULATIVE REGULARITIES. Panteleev, L. I.; Rasin, I. M.; Sarapultsev, I. A. (Inst. of Biophysics, Moscow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

An attempt to substantiate the possibility of extrapolation of strontium-90 accumulative regularities to man by analogy with calcium metabolism in the growing organisms of various species was made in this study. Calcium metabolism regularities were investigated by the rate of its increase in the process of growth and development of the organism. Findings of the experiment on strontium-90 accumulation in pigs depending on the age and their model description were employed as initial data. The possibility of extrapolation of osteotropic isotope metabolism was determined by the regularities of mineral metabolism in bone tissue by employing the unities of the biological time skeleton formation. (auth)

28029 (CONF-720818-, pp 289-296) ALTERED METABOLISM OF STRONTIUM BY PHOSPHATE. Chaudhuri, T. K.; Chaudhuri, T. K. (Univ. of Iowa, Iowa City). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The metabolism of strontium is altered by inorganic phosphate. Strontium and phosphate presumably form a colloid suspension of strontium phosphate both in vivo and in vitro. The colloidal particles of strontium phosphate are temporarily retained in the liver sinusoids because these particles are trapped by the reticuloendothelial cells of the liver. Being unstable, the particles eventually dissociate into individual components (Sr, P), which are released back into the circulation. Thenceforth, the body handles strontium as it would in the absence of phosphate. (auth)

28030 (CONF-720818-, pp 335-346) CERTAIN ASPECTS OF RADIOSTRONTIUM METABOLISM IN MAN. Spencer, H.; Kramer, L.; Norris, C.; Samachson, J. (Veterans Administration Hospital, Hines, IL). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

This report deals with the followfng aspects of radiostrontium in man: Factors influencing the Ca/Sr absorption ratio, effect of stable calcium and effect of the presence or absence of food in the intestine; Inhibition of the absorption of radioactive strontium; Passage of strontium and calcium from the vascular space into the intestine; and Comparative removal of ^{85}Sr and ^{90}Sr. (auth)

28031 (CONF-720818-, pp 357-368) STUDY OF RETENTION OF ^{85}Sr BY A METHOD OF INTEGRATION OF PROFILE SCAN: VARIATIONS IN MISCELLANEOUS BONE DISEASES. Robillard, J.; Loyau, G.; Couette, J. E.; Dumas, M.; Vernhes, J. C.; Gaussard, J.; Van Hoa, L. (Centre Regional de Lutte contre le Cancer, CAEN, France). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

A method of studying the retention of strontium-85 is presented and a simplified technique of counting completely accessible to modestly equipped laboratories is described. That there is effectively an increase of whole strontium-85 retention in most bone diseases and particularly in cancerous metastases is demonstrated. The use of segmentary retentions enables the localization on the affected zones. (auth)

28032 (CONF-720818-, pp 389-396) DISCRIMINATION BETWEEN CALCIUM AND STRONTIUM IN BONE UPTAKE AND LOSS. Shimmins, J.; Smith, D. A. (Western Regional Hospital Board, Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

A new method of kinetic analysis is presented to determine the rate of flow of mineral into the skeleton (M) using isotope tracers. This analysis allows calculation of γ, the fractional loss rate of the tracer isotope from bone. The method is based on the following equation that describes the skeletal uptake and loss of isotope tracer. $Q_t = M \int_0^t S.A._t\, dt - \gamma \int_0^t Q_t\, dt$. $S.A._t$ is the serum specific activity at time t and Q_t is the skeletal isotope uptake at time t. Values of M and γ were measured in eight subjects using ^{45}Ca and ^{85}Sr as isotope tracers. In six osteoporotic subjects there was discrimination against the uptake of strontium by the skeleton ($M_{Ca}/M_{Sr} = 1.87$). There was a similar discrimination against strontium in loss rate from the skeleton ($\gamma_{Ca}/\gamma_{Sr} = 1.84$). It was concluded that a physiological membrane around bone forming sites may be the cause of this discrimination against strontium. (auth)

28033 (CONF-720818-, pp 413-422) SKELETAL UPTAKE OF ^{85}Sr IN RELATION TO AGE AND BONE LOSS IN WOMEN. Smith, D. A. (Western Infirmary, Glasgow); Aitken, J. M.; Anderson, J.; Shimmins, J.; Nordin, B. E. C. 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

It is evident that the rate of mineral uptake as measured by ^{85}Sr falls significantly with age in this group of women who cannot be differentiated from the normal subjects. The physiological interpretation of this data however has yet to be determined. (ERB)

28034 (CONF-720818-, pp 469-476) ^{90}Sr METABOLISM IN THE HUMAN FETUS. Borisov, B. K. (Inst. of Biophysics, Moscow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Strontium-90 accumulation in the skeleton of the developing fetus depends exponentially on the pregnancy time. There is a linear dependence between strontium-90 amount in the bone tissue of the fetus and the growing weight of its body. During the whole period of pregnancy the amount of ^{90}Sr in the fetus skeleton exceeds 2.6 times its amount in the average daily diet of the mother. Placenta is not a strong barrier against the penetration of strontium and calcium. By the end of the pregnancy period these two elements pass through it to the fetus, practically speaking, in the same proportion in which they are present in the blood of the mother. (auth)

28035 (CONF-720818-, pp 521-580) ^{90}Sr IN HUMAN BONE, 1959-70. Warren, J. M. (Western Regional Hospital Board, Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

2144 samples of human bone were analyzed in Glasgow between 1959 and 1970 as part of the fallout strontium-90 monitoring program organized by the Medical Research Council. These bone samples were obtained from post mortem subjects who had been residents in Glasgow or its environs and the analyses were made at the Royal Hospital for Sick Children and at the Department of Clinical Physics and Bio-Engineering, Glasgow. (auth)

28036 RENAL HANDLING OF ^{99m}Tc–Fe–ASCORBIC ACID COMPLEX. Suarez Torres, F.; Constable, A. R.; Joekes, A. M. (Saint Paul's Hospital, London). Nucl. -Med., Suppl.; No. 9 Suppl., 252-259(1971).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992–.

The renal clearance of ^{99m}Tc iron ascorbic acid complex was investigated. Twenty four patients with varying renal conditions ranging from the normal to the anephric were given an intravenous dose of 1.5 mC of the complex. Plasma concentration measurements show an increasingly slow disappearance with diminishing renal function. Early scintiphotos show repeated filling and emptying of the renal pelvis which is rarely symmetrical. Clearance values show a descending tendency over a six hour period. It is suggested that this effect could be explained by different nephron populations having varying ascorbic acid reabsorptive capacities. (auth)

28037 ANTITUMOR AGENT CIS-$Pt(NH_3)_2Cl_2$: DISTRIBUTION STUDIES AND DOSE CALCULATIONS FOR ^{193m}Pt AND ^{195m}Pt. Lange, R. C.; Spencer, R. P.; Harder, H. C. (Yale Univ., New Haven). J. Nucl. Med.; 14: No. 4, 191-195(Apr 1973).

The radioisotopes of platinum ^{193m}Pt and ^{195m}Pt were produced and compared as radiolabels for the antitumor compound cis-Pt

$(NH_3)_2Cl_2$. On the basis of physical characteristics, ^{195m}Pt was the radioisotope of choice. When radiolabeled cis-$Pt(NH_3)_2Cl_2$ (with carrier) was injected into mice bearing sarcoma 180, the tumor/blood ratio of radioactivity varied from 1:3 to 2:0 (4 hr to 5 days after injection). Organ distribution in tumor-bearing mice was similar to that previously noted in control mice. Plasma disappearance data in two patients revealed an initial rapid fall in radioactivity following intravenous injection and then a slower phase. In the two cases, it was estimated that 60 to 70% of the radiolabel was retained after two days. Most excretion of radioactivity was through the urine. (auth)

28038 INTRACELLULAR PLUTONIUM: REMOVAL BY LIPOSOME-ENCAPSULATED CHELATING AGENT. Rahman, Y. E.; Rosenthal, M. W.; Cerny, E. A. (Argonne National Lab. IL). Science; 180: No. 4083, 300-302(20 Apr 1973).

Chelating agents, such as ethylenediaminetetraacetic acid (EDTA) and diethylenetriaminepentaacetic acid (DTPA) were successfully encapsulated within lipid spherules (that is, liposomes). Encapsulated EDTA, given intravenously to mice, was retained longer in tissues than nonencapsulated EDTA. Encapsulated DTPA, given to mice three days after ^{239}Pu injection, removed an additional fraction of plutonium in the liver, presumably intracellular, not available to nonencapsulated DTPA. It also further increased urinary excretion of plutonium. Introduction of chelating agents into cells by liposomal encapsulation is a promising new approach to the treatment of metal poisoning. (auth)

28039 MEASUREMENTS OF THE RADIOACTIVE IODIDE AND PERTECHNETATE UPTAKE FOR THE STUDY OF THE TRAPPING AND BINDING FUNCTIONS OF THE HUMAN THYROID. Koutras, D. A.; Sfontouris, J.; Pandos, P. G.; Chryssikou, M.; Gatsios, D. M.; Malamos, B. (Univ. of Athens). Nucl.-Med.; 11: No. 4, 338-351(30 Dec 1972).

The uptake of ^{131}I and ^{99m}Tc by the thyroid, 5, 30, and 60 min after i.v. administration was measured in 18 normal persons, 45 patients with simple goitre, and 39 patients with Graves disease. The 5 min ^{99m}Tc uptake was higher than that of ^{131}I, but at 30 min and at 60 min the ^{131}I uptake was usually higher than that of the ^{99m}Tc. There was a considerable overlap of all these parameters especially between Graves disease and simple goitre, but a better diagnostic separation of the thyrotoxic patients was achieved by the 60 min ^{131}I uptake than by the other measurements. The ratio of the $^{131}I/^{99m}Tc$ uptakes was higher in the thyrotoxics than in the patients with simple goitre. This difference at 30 and 60 min was statistically significant even if only the goitrous patients with a high ^{99m}Tc uptake were considered. Since ^{131}I is bound organically in the thyroid to a much greater degree than ^{99m}Tc, these findings suggest that in many cases of non-toxic goitre, although the trapping function may be increased as much as in thyrotoxicosis, the binding capacity of the gland is not proportionally increased. This hypothesis was also supported by the fact that following administration of carbimazole, a drug which inhibits organic binding, the 30 and 60 min ^{131}I uptake and the $^{131}I/^{99m}Tc$ ratio were reduced in the patients with Graves disease, but there was no significant effect on those with simple goitre. This supports the conclusion that the thyroidal organic binding of iodide may be impaired in some patients with simple goitre. It was also concluded that early ^{99m}Tc uptake measurements have not a greater diagnostic value than the conventional ^{131}I tests, and so their use as a routine procedure is not recommended. (auth)

28040 STUDIES OF ARTHRITIS WITH ^{99m}Tc. Skupenova, A.; Makaiova, I.; Makai, F.; Hupka, S.; Pipa, V. (Oncological Inst., Bratislava). Nucl.-Med.; 11: No. 4, 396-406(30 Dec 1972). (In German)

The possibilities of diagnosing arthritis with ^{99m}Tc-pertechnetate using profile scanning and photoscintigraphy are described. Patients with arthritis of different aetiology were examined. The results obtained so far indicate that the method is useful not only for detecting the presence and evaluating the intensity of the inflammation, but also for controlling the activity of the inflammatory process following various types of treatment. (auth)

28041 THYROID RADIONUCLIDE UPTAKE MEASUREMENTS. Report of a Panel of Experts of the International Atomic Energy Agency. Acta Radiol., Ther., Phys., Biol.; 11: No. 5, 501-512 (Oct 1972).

The status of tests of thyroid function based on measurements of the uptake of a radioactive tracer by the gland (thyroid uptake tests) is reviewed. Recommendations of a group of consultants convened by the Agency in 1960 to draw up a standardized procedure for thyroid radioiodine uptake measurements are updated and, where necessary, amended. A distinction is made between early uptake tests based on measurements made up to 30 min after administration of the tracer, which reflect primarily the iodine-trapping function of the thyroid gland, and late uptake tests based on measurements made 2 hrs or more after its administration, which reflect primarily the iodine-binding function of the gland. The usefulness of tests of each type is assessed, their requirements are detailed, particularly as regards choice of radionuclide and choice of measurement technique, and consideration is given to clinical conditions and extraneous factors that can lead to the misinterpretation of the results obtained. (auth)

28042 ESTIMATION OF CHEST WALL THICKNESS IN LUNG COUNTING FOR PLUTONIUM. Dean, P. N. (Los Alamos Scientific Lab., NM). Health Phys.; 24: No. 4, 439-441(Apr 1973).

When measuring plutonium in the human lung, difficulties arise due to absorption of the L x rays (17 keV) by the ribs and the tissue between the ribs. This tissue varies in thickness from subject to subject from about 15 to 35 mm, which corresponds to a variation in the transmission factor of 10. Due to this variation of transmission factor an accurate estimate must be made for each individual. The most accurate measurement is with an ultrasonic analyser and results of such measurements are given for 393 subjects. An effort was made to investigate the possibility of estimating the effective tissue thickness for measurements of various body parameters. Using the simplest parameter, that involving the weight/height of the subject, the largest error in the 393 subjects considered would have resulted in an overestimation of the calibration factor by 35%. (UK)

28043 LIGAND AND ISOTOPE EXCHANGE IN THE SYSTEM PLASMA PROTEINS–ZINC–POLYAMINOCARBONIC ACIDS. Segewitz, G. Karlsruhe, Ger.; Karlsruhe Univ. (1972). 49p. (In German).

Thesis.

The mobilization of Zn and ^{65}Zn from the proteins of the human serum by the Ca chelates of EDTA and CDTA was studied in vitro by means of gel filtration on sephadex. During the mobilization of stable Zn and Zn built in during the biosynthesis of Zn, all chelate forming agents showed the same effectiveness despite their different stability, whereas the binding stability of the various Zn proteins was found to be different. A mechanism of mobilization via the formation of an intermediate complex is postulated. For the mobilization of ^{65}Zn it was found that the chelate forming agents are not only more effective in general, as compared with stable Zn, but also show a varying effectiveness (DTPA > EDTA > CDTA) which deviates, however, from the relationship DTPA > CDTA > EDTA that could be expected in theory. It was assumed that ^{65}Zn will label in vitro only a very small fraction of the endogenous Zn and is mainly mobilized by a reaction mechanism via the free Zn-ion. The causes of the quantitative differences lie in the isotopic exchange that follows a different mechanism for each chelate forming agent, as has been demonstrated in experiments with the Zn chelate. As regards DTPA, the isotopic exchange occurs very rapidly, and most probably via the formation of a mixed complex, whereas the reaction with EDTA and especially with CDTA is slower and runs via the free ion. The significance of these results with respect to the toxicity of chelates and the decorporation efficiency of chelate forming agents is discussed. (GF)

28044 RADIATION PROTECTION IN THE USE OF THORIATED TUNGSTEN ELECTRODES. Makedanz, A. ZIS (Zentralinst. Schweisstech.)-Mitt.; 14: No. 2, 235-242(Feb 1972). (In German).

In spite of its low concentration in tungsten electrodes, thorium should not be overlooked as a potential radiation hazard in this context since due to its α radiation it is among the most toxic of the radionuclides, and will accumulate in bone following either inhalation or ingestion. Both internal and external contamination are significant when handling thorium-containing compounds. Physical data on the thorium family are followed by information on maximum permissible doses for different classes of person and organ groups. Studies have shown that external radiation burden is negligible due to the low thorium content of the electrodes and that, under adequate working conditions, internal contamination need not be expected. It is concluded that tungsten-inert-gas welders do not require personal dosimeters. (Occup. Saf. Health Abstr.)

28045 METABOLISM OF ^{137}Cs AND STABLE POTASSIUM IN MAN. Keslev, D.; Boyadzhiev, A.; Novakova, E.; Kerteva, A.; Yakimov, L. Letop. Khig. Epidemiol. Inst.; 4: No. 23, 33-38 (1970). (In Bulgarian).

To establish the possibilities for determining with reliable precision body burdens of cesium-137 data were obtained from the analysis of food, urine, and stools. Persons of different age groups were studied. The results confirmed the standpoint that urinary and fecal analysis is a reliable method for control of the amount of cesium-137 in the organism. More exact and practicable is the urinalysis method. Potassium was determined on flame photometer. Cesium-137 is eliminated mainly with the urine (70.8 to

80.0%) and to a lesser extent with the stools (13.0 to 24.1%). No correlation could be established between total entry of cesium-137 and potassium and their elimination with the urine. (INIS)

Animals

Refer also to abstracts 27942 and 27998.

28046 (AEC-tr-7418, pp 7-15) ACCUMULATION OF RADIOACTIVE ISOTOPES BY THE DEVELOPING EGGS OF THE ATLANTIC SALMON. Kosheleva, V. V. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 8-15(1971).

A study was made of the effect of radioisotopes and the products of nuclear fission for three radioactivity levels. Data were collected on the distribution of activity (in percentage of the total) in the egg membrane, in the fluid of perivitelline space, in the embryonal body and in the yolk. The dynamics of viability of embryos during the incubation period was clarified. It was found that the hatching period for embryos developing in water containing radioisotopes lasts a longer time. It was also found that the products of nuclear fission and ^{144}Ce cause greater changes than ^{137}Cs and $^{90}Sr + {}^{90}Y$. (auth)

28047 (CONF-720818-, pp 31-38) WHOLE-BODY RETENTION OF SINGLE INJECTIONS OF ^{85}Sr IN SWINE AND DOGS AS A FUNCTION OF AGE: A REVIEW. Anderson, J. J. B. (Univ. of Illinois, Urbana). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

It has long been known that the retention of radiostrontium is age-dependent, but it has not always been obvious in reviews that there may be significant differences with respect to age in the potential radiation dangers to man of this alkaline earth. In data obtained from neonatal and from slowly growing sexually mature swine, it would appear not only that the uptake of radiostrontium may be highly variable throughout the skeleton, being especially high in the bones of the head of the mature swine, but also that the turnover of the retained label may be quite variable in the neonate whereas it was highly similar in the mature swine. It is re-emphasized on the basis of the data reviewed here that, because of differences in growth curves, no one animal model is adequate to represent the differential metabolism of the radionuclide as a function of age in man. Data of ^{85}Sr retention by dogs prior to and at the time of puberty appear to approximate quite well the human teenage period, whereas data from the more slowly growing miniature breed of swine would appear to be as close to the neonatal and infant periods of man as possible of the models studied. However, it is recognized that neither of these models of possibly the most critical times for radiostrontium uptake and damage in the life of a human being is entirely satisfactory. Furthermore, it is recognized that pathological changes may represent a better end-point than retention data alone for comparative studies upon which extrapolation to man can be attempted. Nevertheless, full consideration of age-related aspects of skeletal metabolism is essential for a better understanding of any model and hopefully of man. (auth)

28048 (CONF-720818-, pp 111-122) DISTRIBUTION STUDIES ON ^{32}P, ^{45}Ca, ^{85}Sr, AND ^{133}Ba IN THE MOUSE. Stather, J. W. (National Radiological Protection Board, Harwell, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The distribution and retention of a number of bone-seeking radionuclides in the mouse skeleton were studied as a function of age at the time of injection. The radionuclides investigated were ^{32}P, ^{45}Ca, ^{85}Sr, and ^{133}Ba. At 24 hr after I.P. injection into 8-week old mice, the distribution throughout the skeleton of the four radionuclides was essentially identical. In the case of ^{85}Sr, however, the skeleton accumulated about 90% of the total body activity at this time whereas for ^{32}P the amount was only about 40%. In mice that were 3, 8, and 26 weeks old, the concentration of ^{85}Sr varied in the different bones of the skeleton by factors of less than 2, 3, and 5 respectively at 24 hr after injection. Highest levels of activity were found in bones with a high proportion of trabecular bone (e.g., lumbar vertebrae) and lowest concentrations in bones with a high proportion of cortical bone (e.g. radioulna). The relative concentrations of ^{85}Sr in the bones of the skeleton changed considerably with time after injection owing to processes of bone growth and remodelling. In older animals, the levels of activity in various bones became more uniform with time, but in youngest mice injected (3 weeks old) concentrations in individual bones varied by about a factor 9 by 128 days after injection. (auth)

28049 (CONF-720818-, pp 123-136) EFFECT OF TIME ON DISTRIBUTION OF INJECTED RADIOSTRONTIUM IN THE SKELETON OF SIX-MONTH-OLD SWINE. Anderson, J. J. B.; Crackel, W. C.; Norton, H. W. (Univ. of Illinois, Urbana). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The relationship between bone growth as determined by stable calcium accretion and ^{85}Sr retention in individual bones of sexually mature swine, i.e., from ages six months to one year, was studied. In addition, data of other reports on bone growth from birth to six months of age were compared to growth beyond six months following a single intravenous injection of radiostrontium. A better understanding of the gross skeletal metabolism of radiostrontium as a function of age in swine, as a model for man, was the objective of this investigation. (auth)

28050 (CONF-720818-, pp 137-144) ^{90}Y DISTRIBUTION IN MALE MICE AFTER INJECTION OF ^{90}Sr, AND CONSEQUENCES FOR DOSE BURDEN OF BONE, SOFT TISSUE, AND GONADS. Mueller, W. A. (Institut fuer Biologie, Neuherberg, Ger.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The distribution of Sr-90 and Y-90 in mice was followed up over an incorporation period of 9 weeks. Using injection solutions of Sr-90 in equilibrium with Y-90 and free of Y-90 it was established that the soft tissue and gonad dose is mainly due to the amount of Y-90 being present at injection time. Hence extremely high Y/Sr-ratios were found in liver and spleen after injection of Sr-90-Y-90 in equilibrium. The testes showed lower ratios, but still higher at any time than were found in blood and bone. An additional double tracer experiment with the genetically independent radionuclides Sr-85 and Y-88 demonstrated the specific distribution pattern of both elements. (auth)

28051 (CONF-720818-, pp 247-254) ACCUMULATION OF RADIOSTRONTIUM IN HAIR. Strain, W. H.; Pories, W. J.; Flynn, A. (Cleveland Metropolitan General Hospital). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

The radiostrontium content of hair affords a nondestructive method of estimating the body burden of this radionuclide. Studies on the accumulation of strontium-85 in rat hair indicate that the follicle plays an active part in the secretion of the radioisotope into hair that contains only a few parts per billion of stable strontium. The mechanisms by which radionuclides are incorporated into hair are unknown and may involve carbohydrate and sulfhydryl moieties. (auth)

28052 (CONF-720818-, pp 277-288) STRONTIUM INHIBITION OF THE VITAMIN-D INDUCED CALCIUM-BINDING PROTEIN AND THE INTESTINAL CALCIUM ABSORPTIVE MECHANISM. Corradino, R. A. (Cornell Univ., Ithaca, N.Y.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16-19 August 1972.

Substitution of calcium in the diet of chicks with stable strontium resulted in the rapid inhibition of the vitamin D_3-mediated, intestinal calcium absorptive mechanism. Complete inhibition of the vitamin D_3-induced, intestinal calcium-binding protein (CaBP) and, simultaneously, the vitamin D_3-enhanced intestinal absorption of radiocalcium and/or radiostrontium was achieved by virtually complete strontium substitution for dietary calcium. Beryllium, and to some extent barium, also shared the CaBP-inhibiting action of strontium. All alkaline earths, except calcium and barium, the latter of which was toxic within a week, at 0.3 moles/kg of diet, were rachitogenic in that skeletal mineralization was deranged. With dietary strontium : calcium ratios of 1 : 1 or less, there was only a transient inhibition of CaBP synthesis followed by a spontaneous recovery. In chicks fed a diet containing a strontium : calcium ratio of 1 : 2, in which there was initial inhibition followed by spontaneous recovery of CaBP, the calcium absorptive capacity of the intestine was at no time less than normal. It was tentatively concluded that, in order for the inhibitory action of strontium on the intestinal calcium absorptive mechanism to be potentially useful in limiting the hazard of ingestion of radiostrontium from fallout or nuclear accident, a dietary strontium : calcium ratio of at least

2:1 would be necessary. The rachitogenic action of even higher levels of dietary strontium is largely reversible with return to a normal diet but the full extent of rachitogenesis and its reversibility must be explored in animals of different age and/or nutritional and physiological state before specific guidelines can be established. (auth)

28053 (CONF-720818-, pp 297-308) INHIBITION OF RADIOSTRONTIUM ABSORPTION BY CHEMICALLY AND ENZYMATICALLY DEGRADED PRODUCTS OF ALGINATES. Skoryna, S. C.; Hong, K. C.; Tanaka, Y.; Stara, J. F. (Univ. of Montreal). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Alginates extracted from Laminaria hyperborea were degraded chemically, using acid hydrolysis and enzymatically, using alginate lyases isolated from the hepatopancreas of Haliotis discus. Fractions obtained were tested for strontium and calcium absorption-inhibitory activity in male rats in vivo by means of gastric intubation using ^{85}Sr, ^{89}Sr, and ^{45}Ca. Previous studies, which have shown that guluronate-rich fractions are more potent inhibitors of radioactive strontium absorption, were confirmed. The radiostrontium bone uptake reduction was 15% higher in animals receiving enzymatically degraded products and 26% higher in those receiving chemically degraded products when compared to animals receiving undergraded sodium alginate. Absorption of ^{45}Ca was not significantly affected. Degradation products of pectates were less effective than the original compound. The increase of effectiveness by enzymatic degradation is due to increase in guluronic acid units. Studies on chemical degradation products demonstrate the importance of chain-length in obtaining maximum efficiency (optimum ca. 30,000 m.w.) in strontium inhibitory properties. Although similar levels of radiostrontium uptake inhibition can be achieved by chemical and enzymatic degradation of alginates, the significance of enzymatic degradation lies in the possibility of increasing the effectiveness of low-guluronic-acid yield alginates as well as economic aspects of a large scale process. (auth)

28054 (CONF-720818-, pp 309-314) INHIBITION OF INTESTINAL ABSORPTION OF SIMULTANEOUSLY ADMINISTERED ^{47}Ca, ^{85}Sr, ^{133}Ba, AND ^{226}Ra BY DIFFERENT SODIUM ALGINATES. Humphreys, E. R. (Medical Research Council, Harwell, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Experiments are described in which the intestinal absorption of Ca-47, Sr-85, Ba-133, and Ra-226 in mice was measured following a meal of bread containing either one of four alginates or agar. The absorption of strontium, barium, and radium was depressed far more than that of calcium. Significant differences were seen in the effectiveness of the alginates on calcium absorption, and barium absorption was reduced more than strontium absorption by at least two of the alginates tested. The results are discussed in relation to the influence of the method of administration on the effectiveness of alginate therapy in reducing absorption of radioisotopes of strontium, barium, and radium. (auth)

28055 (CONF-720818-, pp 315-324) PROMOTION OF EXCRETION OF INJECTED ^{85}Sr, ^{133}Ba, AND ^{224}Ra FROM THE RAT BY INJECTED DERIVATIVES OF SODIUM ALGINATE. Humphreys, E. R.; Howells, G. R. (Medical Research Council, Harwell, Eng.). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Experiments with twelve week old female rats are described in which it was shown that the retention of ^{85}Sr in the carcass was reduced substantially by the simultaneous injection of sodium alginate derivatives. The effect, although much reduced, was still apparent when the injection of alginate derivative was delayed for four hours. Similar but smaller effects were seen for barium and radium; the excretion of calcium was affected only slightly. The mode of action and possible therapeutic value of the alginate derivatives is discussed. (auth)

28056 (CONF-720818-, pp 347-356) PASSAGE OF ^{85}Sr AND ^{47}Ca INTO THE INTESTINAL TRACT OF RATS. Warren, J. M.; Spencer, H. (Western Regional Hospital Board, Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The secretion of ^{47}Ca into the intestine reaches equilibrium within one hour following intravenous administration of the isotope. Such an equilibrium has not been established with ^{85}Sr. The data indicate that there is also preferential reabsorption of calcium from the intestine. The reabsorption of both ^{85}Sr and ^{47}Ca is greater during fasting than during feeding and again that of ^{47}Ca exceeds that of ^{85}Sr. (auth)

28057 (CONF-720818-, pp 369-378) COLD: POSSIBILITY FOR INCREASING THE EXCRETION OF RADIOSTRONTIUM. Wedin, B.; Nilsson, A.; Roennbaeck, C. (Research Inst. of the Swedish National Defence, Sundbyberg). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

Second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Investigation seemed to indicate that the increase of ^{85}Sr excretion in mice under cold conditions is not an effect of common stress but is specifically evoked by cold stress. However, more extensive investigations are necessary. (auth)

28058 (CONF-720818-, pp 379-388) STRONTIUM AND CALCIUM KINETICS AT THE BONE LEVEL. Harrison, J. E.; McNeill, K. G.; Elaguppillai, V. (Univ. of Toronto). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

The validity of the use of strontium under conditions of physiological stress was studied. These stresses were a prolonged low calcium diet, and the administration of parathyroid extract (PTE), which will increase the resorption of calcium (and strontium) from bone. In addition, under normal conditions, the effect of different amounts of strontium carrier was tested. (ERB)

28059 (CONF-720818-, pp 397-402) COMBINED INFLUENCE OF DIET, ALGINATE, PARATHYROID HORMONE AND VITAMIN D ON ^{85}Sr AND ^{47}Ca MOBILISATION FROM BONE. Vanderborght, O.; Keslev, D.; van Puymbroeck, S.; Colard, J. (SCK/CEN, Mol, Belgium). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

Sodium alginate can nearly double the ^{85}Sr concentration in blood of mice with a 3 week old ^{85}Sr contamination. This action was further analyzed when it is combined with other factors known to influence Ca metabolism, such as parathyroid hormone and vitamin D_2 (ergocalciferol). (auth)

28060 (CONF-720818-, pp 403-412) RELATIVE UPTAKE OF ^{45}Ca AND ^{85}Sr INTO BONE. McQueen, C. M.; Smith, D. A. (Univ. of Glasgow). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

These investigations show that discrimination against ^{85}Sr uptake into bone (shown by both specific activity (S.A.) and rate of stable Ca uptake) occur in the low density fractions. The position is reversed in the high density fractions. Taken together, the results show that there is discrimination against the uptake of ^{85}Sr in low specific gravity (S.G.) fractions of bone and in largely trabecular bone. The low density fractions correspond to newly-formed bone as shown by the high S.A. of tritiated hydroxyproline in the low density fractions, and this would fit with the suggestion that trabecular bone turns over at a faster rate than cortical bone. The discrimination could, therefore, occur as a result of a cellular membrane interposed between the extracellular fluid and the newly-forming bone. Alternatively, it could result from the physicochemical differences between new and old bone. The results also show that both ^{85}Sr and ^{45}Ca are lost from newly-formed low S.G. bone and from high S.G. old bone. The apparent discrimination in favor of ^{85}Sr retention seen in the higher S.G. bone is more difficult to explain. One possible explanation is that the rates of uptake of ^{45}Ca into and rate of loss from high density bone occur so rapidly that the changes have occurred largely before the investigation at 3 days. The slower ^{85}Sr could result from slower diffusion out of bone. (auth)

28061 RESULTS OF CLINICAL NUCLEAR MEDICINE. Diagnostic, Therapy, Research. Conference held at Zurich, Switzerland, September 25–27, 1969. Horst, D.; Pabst, H. W. (eds.). Nucl. -Med., Suppl.; No. 9 Suppl., 1-1137(1971). (In several languages). (CONF-690992–).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

Topics covered include: tumor diagnosis, pulmonary-scintigraphic functions, kidney functions, cyclotron uses, data processing for scintigraphy, tracer techniques, new camara development, radiation effects, scanning and diagnostic techniques, and new radiopharmaceuticals. Separate abstracts were prepared for 18 papers. (MCG)

For abstracts of individual papers see: 27289–27291, 27338, 27378, 27641, 27889, 27951, 27994, 28036, 28062, 28077–28079, 28351–28353, and 28427.

28062 METABOLISM OF RADIOACTIVE SILVER AND MERCURY COMPOUNDS BY TUMOR BEARERS IN ANIMAL EXPERIMENTS. Habighorst, L. V.; Buchwald, W. (Univ., Mainz). Nucl.-Med., Suppl.; No. 9 Suppl., 35-38(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

Radioactive silver and mercury compounds are accumulated to a detectable degree in the tumor tissue of rats transplanted with myelosarcoma T 58. The accumulation can be demonstrated by scintigraphy and autoradiography. The tumor-blood ratio is more favorable for $^{203}HgCl_2$ than for $^{110m}AgNO_3$. The metabolism of the two substances shows characteristic differences. Mercury chloride is concentrated largely by the kidneys, while silver nitrate is excreted almost quantitatively through the hepato-biliary route. (tr-auth)

28063 INHALED IRRADIATED TERPHENYLS. Adamson, I. Y. R. (Univ. of Manitoba, Winnipeg). Arch. Environ. Health; 26: No. 4, 192-196(Apr 1973).

Mice were exposed to an aerosol of irradiated reactor coolant HB40 (a terphenyl mixture) for four hours daily up to eight weeks. No evidence of pulmonary injury was seen by light microscopy. From ultrastructural observations, free membrane debris in the alveoli was rapidly cleared and some mitochondria in a few type 2 alveolar epithelial cells became vacuolated. In the liver, there was an increase in smooth endoplasmic reticulum which is interpreted as an adaptive reaction with increased production of microsomal proteins. Both lung and liver changes were reversed a few weeks after cessation of exposure to an aerosol dose five orders of magnitude higher than that present at the reactor site. (auth)

28064 STUDIES ON RADIOPHARMACEUTICALS. Synthesis of a New Renal Scanning Agent and Basic Studies. Tanaka, A. (National Inst. of Hygienic Sciences, Tokyo); Tojyo, K. I.; Urakubo, G.; Miki, M.; Machida, T.; Minami, T. Nucl.-Med.; 11: No. 4, 407-418(30 Dec 1972).

An attempt was made to produce a new renal scanning agent with faster excretion rate, smaller radiation exposure, and cheaper cost than those of chlormerodrin. A new compound 1-(4-iodophenyl)-3-[3-(chloromercuri)-2-methoxypropyl]urea (abbrev.: IPCM) labeled with ^{125}I was prepared for the first time in four steps with 4-iodoaniline labeled with ^{125}I as the starting material. The kidney affinity of the compound was examined by using male Wistar rats. The distribution of ^{125}I in the organs at various intervals after administration was calculated using an organ/muscle activity ratio. The kidney accumulated more ^{125}I than any other organ. The liver accumulated less ^{125}I than the kidneys, but much more than any other organ. When the body retention of ^{203}Hg-chlormerodrin and ^{203}Hg-or ^{131}I-IPCM was compared, similar biphasic excretion curves were found with both compounds. The urinary and fecal excretion rates of IPCM were nearly the same. Imaging of rabbit kidneys was also tried with a scintillation camera and ^{133}I-IPCM. Some problems of the clinical application of IPCM are discussed with a view to the use of ^{123}I in the future. (auth)

28065 ABSORPTION, DISTRIBUTION, AND MILK SECRETION OF RADIONUCLIDES BY THE DAIRY COW. 2. Radiorubidium: Mullen, A. L.; Stanley, R. E.; Moghissi, A. A. (Western Environmental Research Lab., Las Vegas, NV). Health Phys.; 24: No. 4, 417-422(Apr 1973).

Four lactating cows were given a single oral dose of $^{86}RbCl$. For the next 4 days, all milk, urine, and feces from the four cows were collected and the ^{86}Rb content measured. Eighteen hours after ingestion of the radionuclide, a maximum concentration of 0.16% of the dose per liter appeared in the milk. The activity was eliminated by the cow with biological half-times in milk of 13 and 84 hr. Half of the ^{86}Rb was excreted in 66 hr. During this time 8% was secreted in the milk, 12% was excreted in the feces, and the remaining 30% in the urine. At the end of 180 hr approximately 75% of the administered activity has been eliminated. In a companion study, a lactating dairy cow was administered ^{86}Rb i.v. and 3 calves were dosed orally. The animals were sacrificed at various times after administration to measure the tissue distribution of the radionuclide. Deposited activity was highest in the liver, thymus, pancreas, muscle, and other soft tissue. Based on the results of this study, rubidium is readily absorbed by the dairy cow and a substantial portion is transferred to milk. (auth)

28066 DISTRIBUTION OF THORIUM SERIES NUCLIDE IN BEAGLES AFTER INTRASPINAL THOROTRAST INJECTION. McNeill, K. G.; Molla, M. A. R.; Harrison, J. E. (Univ. of Toronto). Health Phys.; 24: No. 4, 403-409(Apr 1973).

Thorotrast (~2 ml) was injected intraspinally and intraveneously into adult beagle dogs. Excretion rates of thorium daughters were measured; distributions of thorium and its daughters in the dogs were measured at times between injection and sacrifice ranging from 1 to 550 days. A significant but variable amount (10 to 60%) of the thorium escapes from the spinal cord and is picked up largely by the liver. The washout of thorium daughters from thorotrast retained in the central nervous system was similar to that from thorotrast localized in the RES following iv injection; thus kinetic parameters derived from iv data can be used in calculating doses produced by intraspinal injection. Histological examination shows that after 100 days there is damage to nerve roots, and after 550 days considerable damage. At this time it is estimated that the dose of the cauda equina from alpha rays is about 1000 rads. (auth)

28067 ^{129}I IN THYROID GLANDS. Boulos, M. S.; Becker, V. J.; Manuel, O. K. (Univ. of Missouri, Rolla). Health Phys.; 24: No. 4, 375-378(Apr 1973).

The amounts of ^{129}I present in mammalian thyroid glands were determined by a combination of neutron activation and mass spectrometry. Contemporary thyroid glands contain $^{129}I/^{127}I \approx 10^{-8}$ and commercial I_2 contains $^{129}I/^{127}I \leq 10^{-10}$. The latter ratio may reflect the lower detection limit of this technique at a neutron flux of 10^{14} neutrons cm^{-2} sec^{-1} due to the production of ^{129}I from double neutron capture on ^{127}I during the irradiation. (auth)

28068 SEASONAL CHANGES IN ^{32}P AND ^{45}Ca METABOLISM IN FRIESIANS AND WATER BUFFALOES. Kamal, T. H.; Abdelaal, A. E. (Atomic Energy Establishment, Cairo). pp 111-120 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Phosphorus-32 and ^{45}Ca were injected separately into the jugular vein of eight nonlactating and nonpregnant Friesian cattle and eight water buffaloes in winter (15.6°C, 54% RH) and in summer (27.6°C, 62% RH). Plasma, urine, and feces samples were collected at seven intervals for 120 hr after dosing, and the kinetics and total excretions of the radioisotopes were studied. In summer urinary ^{32}P excretion increased insignificantly in Friesians and decreased ($p < 0.05$) in buffaloes. Fecal ^{32}P excretion showed no seasonal differences in both species. Plasma ^{32}P was higher in summer than in winter in Friesians and vice versa in buffaloes ($p < 0.01$). In summer ^{32}P retention insignificantly decreased in Friesians but increased in buffaloes ($p < 0.01$). Urinary ^{45}Ca excretion was higher in summer than in winter in both species ($p < 0.01$). Fecal ^{45}Ca excretion was lower in summer than in winter, insignificantly in Friesians and significantly ($p < 0.01$) in buffaloes. Plasma ^{45}Ca was insignificantly lower in summer than in winter in both species. In summer ^{45}Ca retention insignificantly decreased in Friesians and increased in buffaloes. The urinary $^{32}P/^{45}Ca$ ratio was lower in summer than in winter in both species ($p < 0.01$). The kinetic studies with the radioisotopes confirmed the above results. Increased urinary ^{45}Ca excretion and decreased urinary $^{32}P/^{45}Ca$ in summer in both species suggest a decrease in parathyroid activity and a possible increase in glucocorticoids secretion in summer. This seems to be of higher magnitude in Friesians than in buffaloes since these changes were greater in the former than in the latter. The lack of significant seasonal change in fecal ^{32}P excretion in both species and the lack of significant decrease in urinary ^{32}P excretion in Friesians may be due to the interaction between the parathormone and glucocorticoids effects on phosphorus metabolism which seems to be more pronounced in Friesians. The results suggest that buffaloes are more heat tolerant than Friesians. (auth)

Plants

Refer also to abstracts 27590 and 27944.

28069 (AEC-tr-7418, pp 195-206) PHOTOSYNTHESIS AND THE MECHANISM OF THE ACTION OF CYANIDE ON CELL RESPIRATION AND ^{239}Pu ACCUMULATION BY MARINE ALGAE. Zlobin, V. S.; Perlyuk, M. F. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 159-168(1971).

Cultivation of the brown alga Ascophyllum nodosum in the control (addition of ^{239}Pu in a concentration $n \cdot 10^{-6}$ μcurie) and experimental aquaria (plutonium in the same concentration and cyanide in a quantity $1 \cdot 10^{-4}$ M) revealed a stable suppression of accumulation of an α-emitter by algae in the presence of an inhibitor. As a result of chromatographic separation of amino acids in plant hydrolysates the greatest activity was registered in serine–glycine (34.66%), histidine (31.94%), and α–alanine (10.49%). Quantitatively these acids also predominated. In the samples investigated it was established by the electrophoretic method that the tag is incorporated into hypoxanthine and adenosine monophosphoric acid. The introduction of the cell respiration inhibitor cyanide into the energy system of algae caused a response reaction in the form of a decrease in plutonium accumulation by plant cells. It is postulated that assimilation of colloid particles of plutonium occurs as a result of ultraphagocytosis. (auth)

28070 (AEC-tr-7418, pp 207-217) ACTIVE PHASE OF ASSIMILATION OF ^{239}Pu BY THE MARINE ALGAE ASCOPHYLLUM NODOSUM. Zlobin, V. S. Mar 1973. Translated from Tr., Polyar. Nauch.-Issled. Proekt. Inst. Morsk. Ryb. Khoz. Okeanogr.; No. 29, 169-175(1971).

A study was made of the problem of accumulation of ^{239}Pu by the brown alga Ascophyllum nodosum during suppression of cell respiration. As the inhibitors the author used sodium cyanide in a concentration of $1 \cdot 10^{-4}$ M, ammonium chloride 10 mM and 100 mM and cadmium chloride 2 mM. It was established that they cause a decrease in the ^{239}Pu accumulation factors in dependence on the substrate on which they act. A study was made of the mechanism of this phenomenon and it was possible to establish the dependence of the intensity of cell respiration and the accumulation factor. The article gives hypotheses on the means and methods by which ^{239}Pu in a colloidal state penetrates through the cell membrane. (auth)

28071 (BNWL-1650(Pt. 2), pp 3.1-3.24) TERRESTRIAL PLANT ECOLOGY. Dec 1972.

In Pacific Northwest Laboratory annual report for 1971 to the USAEC Division of Biology and Medicine. Volume I. Part 2.

The impact of the abiotic and biotic environments on plant distribution, growth, reproduction, and yield was studied at the Arid Land Ecology (ALE) Reserve. Terrestrial plant ecology, a focal point of the ecology studies, is also concerned with the movement and accumulation of mineral nutrients and radionuclides by plants and their relationship to the soil substrate. A new direction was taken in studies on physiological ecology, where moisture use and mineral behavior within the plant are being studied. (auth)

28072 RETENTION AND REMOVAL OF ^{131}I FROM CONTAMINATED VEGETABLES. Thompson, J. C.; Howe, M. (New York State Veterinary Coll., Ithaca). Health Phys.; 24: No. 3, 345-351 (Mar 1973).

Iodine-131 was applied as a spray (NaI solution) to various edible food plants to examine retention and removal characteristics under controlled conditions as a guide in developing potential countermeasures for radioactive releases from nuclear reactors, fuel reprocessing plants, or other sources. Leafy plants were highest in retention capability and would warrant greatest concern in any release. Seventy-five to ninety % of the ^{131}I deposited on most vegetables can be removed by ordinary household preparation practices; thus it would seem that extremely high contamination levels would have to occur before usage would be completely restricted. Solving the problem of ^{131}I intake during major releases may be as simple as converting to processed foods during the emergency period but the implications on public, agricultural, and industrial interests cannot be overlooked. Knowledge of the comparative ^{131}I removal characteristics for various plant foods would aid in determining appropriate courses of action. (auth)

New Tracer Techniques

Refer also to abstracts 27378, 27632, 28037, 28061, and 28068.

28073 (CONF-720818-, pp 79-89) USE OF ^{87m}Sr AND SEMICONDUCTOR RADIATION DETECTORS FOR IN VIVO PHYSIOLOGICAL STUDIES. Marcus, C. S. (Univ. of Southern California, Los Angeles). 1972.

From 2nd international conference on strontium metabolism; Glasgow and Strontian, UK (16 Aug 1972).

In second international conference on strontium metabolism, Glasgow and Strontian, 16–19 August 1972.

A peak mineralization activity in healing oral bone was found in rats 1½ to 2 weeks post-injury. The system for monitoring this effect is unique in that it permits nondestructive, direct measurement and may be repeated as often as every 24 hrs on the same animal. Metastable ^{87}Sr, a short-lived, generator-produced radionuclide, was found to be extremely useful for this study. A silicon avalanche radiation detector and a new type of lithium-drifted silicon microprobe detector were used to make these measurements. (auth)

28074 (COO-1422-55) BODY COMPOSITION BY ABSORPTIOMETRY OF MONOENERGETIC RADIATION. Mazess, R. B.; Cameron, J. R.; Sorenson, J. A. (Wisconsin Univ., Madison. Dept. of Radiology). [nd]. 8p. Dep. NTIS $3.00.

The relative compositions of lean cellular mass versus fat mass in soft tissue in vivo and of organic tissue versus mineral in excised bone were studied by radiation absorption measurements using ^{241}Am or ^{125}I sources. Methods, sources of error, advantages of the method, and uses are discussed. (MCG)

28075 (INIS-mf-270) FIRST ASIAN AND OCEANIAN CONGRESS OF RADIOLOGY, MELBOURNE, 22–26 NOVEMBER 1971. Abstracts of Papers. (College of Radiologists of Australasia, Melbourne (Australia)). 1971. vp. (CONF-711145-(Absts.)). INIS.

From 1st Asian and oceanian congress of radiology; Melbourne, Australia (22 Nov 1971).

Abstracts of 20 papers given at the First Asian and Oceanian Congress of Radiology at Melbourne, Australia on November 22 to 26, 1971 are presented. The papers discuss radiographic, radiodiagnostic, and radiotracer applications. (ERB)

28076 (STI/PUB-309) ISOTOPE STUDIES ON THE PHYSIOLOGY OF DOMESTIC ANIMALS. Proceedings of a Symposium Held in Athens, March 20–24, 1972. (International Atomic Energy Agency, Vienna (Austria)). Sep 1972. 419p. (In Several Languages). (CONF-720345-). IAEA $13.00.

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972).

Separate abstracts were prepared on 12 papers presented at this symposium. (CH)

For abstracts of individual papers see: 28068 and 28090–28100.

28077 TWO NEW POSSIBILITIES FOR IN-VIVO MEASUREMENT OF GAMMA-EMITTING NUCLIDES. Kuenkel, H. A.; von Weizsaecker, E. U. (Univ., Hamburg). Nucl. -Med., Suppl.;, No. 9 Suppl., 84-86(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

Radioactive isotopes which emit simultaneously two or more γ photons per decay were used for the detection of cold areas on radioisotope scans. The field of vision of two lead collimators, placed at a right angle to each other, intersected in the volume under study. Coincidence counting was then performed. The major disadvantage of the method was the relatively long counting time. The same geometrical arrangement was used with normal gamma emitters and with a count multiplicator. This arrangement permitted the measurement of rapidly changing activities within a small volume. Clinical application to circulatory measurements appeared promising. (HBG)

28078 APPARATUS OF THREE-DIMENSIONAL ISOTOPE MEASUREMENTS IN VIVO WITH THE HELP OF GAMMA COINCIDENCE. Schmitz Feuerhake, I.; Froehlich, H.; Hundeshagen, H.; Nentwig, C. (Medizinische Hochschule, Hanover). Nucl. -Med., Suppl.; No. 9 Suppl., 87-91(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

Three-dimensional scintigraphy for tumor localization with gamma cascade isotopes such as ^{75}Se, ^{111}In, ^{183}Re, ^{79}Kr permitted a presentation of high contrast. A simple additional apparatus for use with a rapid scanner was developed. Because of accidental coincidences, the resolution time for coincidences should be not much higher than 10 nsec; correction for accidental coincidences should be possible. (tr-auth)

28079 NEW METHOD OF LABELING RED BLOOD CORPUSCLES WITH ^{99m}Tc AND ITS CLINICAL SIGNIFICANCE. Hennig, K.; Franke, W. G.; Woller, P.; Berger, R.; Johannsen, B. (Carl Gustav Carus Medizinische Akademie, Rossendorf, Ger.). Nucl. -Med., Suppl.; No. 9 Suppl., 538-543(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992-.

Through the insertion of a reduction step with Sn ions into the labeling process, a technetium-erythrocyte binding was obtained, which proved to be extremely stable in vitro as well as in vivo. The labeled erythrocytes were used successfully for the determination of erythrocyte volume and for scintigraphy of the placenta.

After alteration, the red blood cells were still labeled so firmly with ^{99m}Tc that they could be used for selective scintigraphy of the spleen as well as for diagnostic tests of spleen function. (tr-auth)

28080 RADIOBACTERIOLYSIS: A NEW TECHNIQUE USING CHROMIUM 51 FOR ASSAYING ANTI-VIBRIO CHOLERAE ANTIBODIES. Blachman, U.; Clark, W. R.; Pickett, M. J. (Univ. of California, Los Angeles). Infec. Immunity; 7: No. 1, 53-61(Jan 1973).

A new method for detecting and quantitating antibodies against Vibrio cholerae is described. The reaction involves the release of ^{51}Cr from prelabeled vibrios in the presence of specific antibody and complement. The entire assay can be completed within 5 hr. The method is highly reproducible, immunologically specific, temperature- and complement-dependent, and significantly more sensitive than other methods currently used for titration of anti-Vibrio cholerae antibodies. The technique is also potentially applicable to titration of antibodies against other gram-negative bacteria. (auth)

28081 RADIOMETRIC DETECTION OF SOME FOOD-BORNE BACTERIA. Previte, J. J. (Army Natick Labs., MA). Appl. Microbiol.; 24: No. 4, 535-539(Oct 1972).

Studies on detection of bacteria by radiometric techniques were concerned primarily with aerobic species in clinical specimens. The data presented here are related to detection of aerobic and anaerobic species that are of significance in foods, by measurement of $^{14}CO_2$ evolved from the metabolism of ^{14}C-glucose. Salmonella typhimurium and Staphylococcus aureus were inoculated into tryptic soy broth containing 0.0139 μCi of ^{14}C-glucose/ml of medium. Detection times ranged from 10 to 3 hr for inocula of 10^0 to 10^4 cells/ml of broth. Heat-shocked spores of Clostridium sporogenes or C. botulinum were incubated in tryptic soy broth supplemented with Thiotone and $NaHCO_3$. The medium was rendered anaerobic with N_2. Spores were detected when 0.0833 μCi of labeled glucose was available/ml of medium but not when 0.0139 μCi of glucose was present/ml. The spores required 3 to 4 hr longer for detection than did comparable numbers of aerobic vegetative cells. The results demonstrate the importance of availability of sufficient label in the media and the potential of the application of this technique for sterility testing of foods. (auth)

28082 YEAR BOOK OF NUCLEAR MEDICINE, 1973. Quinn, J. L. III. Practical Medicine Year Books. Chicago; Year Book Medical Publishers, Inc. (1973). 407p.

Summaries of recent publications up to September 1972 in the world literature in the field of nuclear medicine are presented. Techniques for radioimmunoassay, protein-binding assay, and other saturation assay tests are discussed in one chapter. Eight chapters discuss radioisotope diagnostic tests for various physiological systems and tissues. Imaging instruments, labeled compounds, data processing systems, and radiation protection applicable to nuclear medicine are included. (CH)

28083 IMPAIRMENT OF DEEP LUNG CLEARANCE BY INFLUENZA VIRUS INFECTION. Creasia, D. A.; Nettesheim, P.; Hammons, A. S. (Oak Ridge National Lab., TN). Arch. Environ. Health; 26: No. 4, 197-201(Apr 1973).

Experimentally observed effects of influenza virus infection on pulmonary clearance of chromic oxide dust tagged with chromium 51 ($^{51}Cr_2O_3$) by mice are reported. The usual course of this viral infection produces a stage of acute pneumonitis at 10 to 14 days after exposure, with subsequent, and often permanent, fibrotic scarring of the lung tissue. When $^{51}Cr_2O_3$ was administered simultaneously with, or at 1, 3, 5, 9, or 56 weeks after virus inoculation, a marked deficiency in pulmonary clearance of the dust was noted. The distribution of retained chromium in the lungs of infected animals was found to depend on the relation between time of infection and time of $^{51}Cr_2O_3$ administration, a relationship which suggests that individuals with respiratory infections are at increased risk from exposure to toxic and radioactive particles. (auth)

28084 LABELED FERROUS ASCORBATE. Usefulness in Renal Scintigraphy. Nouel, J. P. (Centre Henri Becquerel, Rouen, France); Brunelle, P.; Renault, H.; Robert, J.; Bertrand, A.; Dubois, D. Nouv. Presse Med.; No. 36, 2399-2401(14 Oct 1972). (In French).

A new substance (technetium-labeled ferrous ascorbate) for renal scintigraphy, presented in the form of a convenient pack, was studied. The labeling efficiency of this compound is 95%. Studies with animals demonstrated its nontoxicity and its selective fixation on the kidneys (10% of the injected dose after a 15 min to 1 hr period). In man, the renal clearance is 77.5 ± 2.5 ml/mn. Two hundred and fifty renal scintigraphs were carried out with this product. Even in the case of renal failure, the image quality was always excellent. The smallness of the radiation dose delivered enables the techniques to be used extensively even with children. (France)

28085 RECOMMENDED METHODS FOR RADIOISOTOPE RED CELL SURVIVAL STUDIES. Nucl.-Med.; 11: No. 4, 352-361 (30 Dec 1972).

Methods are described for standardizing details of the radiochromium method of labeling red cells and methods of deducing mean cell life from radioactive chromium measurements are described. Techniques using DF ^{32}P and ^{3}H-DFP are also described. Methods for analysis of red cell survival data are discussed and the use of isotope-labeled red cells as a test of compatibility is described. A table is presented to show radiation dose to the patient in red cell survival studies. (HLW)

28086 DETERMINATION OF THE VITAMIN A BODY POOL OF RATS BY AN ISOTOPIC DILUTION METHOD. Rietz, P.; Vuilleumier, J. P.; Weber, F.; Wiss, O. (F. Hoffmann-La Roche and Co., Ltd., Basel). Experientia; 29: No. 2, 168-170(15 Feb 1973).

The total body pool of vitamin A in rats was determined using a carbon-14 isotopic dilution method. The results demonstrate that a dose of labeled vitamin A is diluted by the preexisting vitamin A body pool leading to equal specific radioactivities of the vitamin A in blood and liver a certain time after treatment. This equilibrium is attained in 7 days in rats, thus it is possible to calculate the vitamin A content of liver from its total radioactivity and the equilibrated specific radioactivity of the plasma vitamin A after administration of labeled vitamin A. (ERB)

28087 PRODUCTION OF RADIOSULPHATE AND RADIOSELENATE, AND THEIR REUTILISATION FOLLOWING INJECTION OF ^{35}S-CYSTINE AND ^{75}Se-SELENOCYSTINE. Awwad, H. K.; El Sheraki, A. S.; El Shetaiwi, S.; Helmi, S. (Cairo Univ.). Int. J. Appl. Radiat. Isotop.; 24: No. 2, 91-97(Feb 1973).

The yield of radioselenate following ^{75}Se-selenocystine injection was much smaller than that of radiosulphate after ^{35}S-cystine administration in the same rat. This could be attributed to two factors at least. Utilisation of ^{75}Se-selenocystine in protein synthesis was much greater than in the case of ^{35}S-cystine, hence posing a greater degree of competition with the oxidative pathway. Moreover experimental evidence is presented to indicate that selenium of inorganic selenate, in contrast to sulphate sulphur, is very efficiently reutilised in the synthesis of seleno-amino acids. These features of selenocystine metabolism preclude its use as a tracer for its sulphur analogue particularly in quantitative metabolic studies. (auth)

28088 DIRECT RADIOIMMUNOASSAY OF RENIN ACTIVITY IN PLASMA. Vincent, M.; Geyssant, A.; Sassard, J. (Univ., Lyon). Compt. Rend. Soc. Biol.; 166: No. 4, 643-648(1972). (In French).

A radioimmunoassay technique is described for measuring the plasmatic renin in blood samples as small as 0.5 ml. The technique has the advantage of not requiring any prior extraction of the hormone product. It appears to be sensitive and reproducible although its value will only be fully appreciated after detailed comparisons with the results of biological methods have been undertaken. (France)

28089 RADIOIMMUNOASSAY FOR SUBSTANCE P. Powell, D.; Leeman, S.; Tregear, G. W.; Niall, H. D.; Potts, J. T. (Massachusetts General Hospital, Boston). Nature (London) New Biol.; 241: No. 112, 252-254(21 Feb 1973).

The presence of substance P was previously demonstrated in extracts of brain and intestine and found to cause contraction of isolated intestinal muscle in vitro and vasodilatation and hypotension in vivo. The development and application of a radioimmunoassay for substance P is described. Synthetic substance P^4 was coupled to bovine gamma globulin. Rats and guinea-pigs immunized with the conjugate were bled 50 days later and their sera tested for ability to bind ^{125}I-labelled substance P. Dose-response curves are presented for synthetic, bovine substance P, and crude extract of bovine, rat, and human brains. The minimum detection limit was 0.3 ng of peptide/incubate volume of 0.5 ml, at a dilution of 1:8,000. Related peptides physalemin and eledoisin did not displace tracer from antibody. The technique was used to confirm the distribution of substance P in nervous tissue, give evidence for the structural similarity between bovine substance P, and that of rats and humans, and set an upper limit of 2 ng/ml for the concentration of substance P in the circulation in man. (UK)

28090 NUCLEAR TECHNIQUES FOR IN VIVO DETERMINATION OF BODY COMPOSITION: A REVIEW. Ward, G. M.; Johnson, J. E. (Colorado State Univ., Fort Collins). pp 3-20 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

A variety of nuclear techniques, mostly adopted from human medical research, were shown experimentally to provide in vivo estimates of the chemical composition of domestic animals. The major emphasis, however, was placed on techniques for the estimation of total body water by means of deuterium or tritium, or the estimation of total body potassium by means of ^{42}K dilution or by determination of ^{40}K in a whole-body counter. Other methods include determination of the red-cell mass of the blood by use of ^{51}Cr and ^{85}Kr as tracers. The principle for the various techniques is well documented and some of the methods (i.e., body water and body K) have been investigated extensively for the past two decades. It has been clearly shown that estimates of the chemical composition of living animals can be derived which cannot be obtained by any other means. Data to document the reliability and sensitivity of the methods are limited. This is because in human studies direct determination of body composition is very difficult and only comparisons between different methods are possible, and each method has its own inherent errors and uncertainties. Isotope studies combined with slaughter and chemical analysis have been reported and include tritium dilution in sheep, goats, and rabbits; deuterium dilution in pigs and sheep; ^{42}K dilution in pigs; ^{40}K in pigs, sheep, and cattle; and ^{51}Cr-labeled red blood cells in pigs. In general, the errors were 2 to 3% for estimates involving deuterium, tritium, and ^{40}K. Greater errors have generally been reported for the few estimates involving ^{40}K. (auth)

28091 STUDIES ON BODY COMPOSITION OF CATTLE BY ISOTOPE DILUTION ANALYSIS. Pfau, A.; Salem, M. A. I. (Max Planck Inst. for Animal Breeding and Animal Nutrition, Mariensee, Ger.). pp 21-34 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Forty-three 18-month-old fattening bulls averaging 550 kg live weight were used to determine simultaneously exchangeable water, potassium, and sodium content in vivo, and morphological and gross chemical body constituents in vitro. Evaluation of the data obtained from HTO, ^{42}K, and ^{24}Na dilution techniques, carcass composition studies, and statistical analysis indicated: the extrapolation method appeared to be more reliable than other procedures, when HTO and ^{24}Ns were determined in blood serum, and ^{42}K and ^{24}Na in urine; the over-estimation of total body water due to the exchange of hydrogen ions was approximately 5% of the live weight, and 97.4 ± 4.6% of whole body potassium and 90.1 ± 4.5% of whole body sodium were exchangeable in bulls; there were highly significant correlations between exchangeable and chemical or morphological body components as well as between the ratio of meq exchangeable K + Na to meq serum K + Na-concentration and HTO determined water space; relative water content of the fat-free body of bulls was 71.0 ± 0.95%, and gastrointestinal fill increased this value up to 73.3 ± 0.90%; good consistency was obtained for body potassium as related to fat-free solids in bulls with empty and filled gastrointestinal tracts (7.91 ± 0.62 g/kg and 7.92 ± 0.63 g/kg), and the ratio of meq exchangeable (K + Na) to meq serum water (K + Na) concentration in relation to corrected HTO−T.B.W. was 1.01 ± 0.08. Chemical analysis of tissues of dissected bulls revealed that reliable predictions of gross body components in terms of fat, protein, and ash are possible from total empty body water. Therefore, a more accurate prediction on integral body composition of large ruminants by indirect methods could be obtained if there were new ways of determining the weight of gastrointestinal contents. (auth)

28092 EVALUATION OF ^{82}Br AS AN EXTRACELLULAR WATER TRACER IN RUMINANTS. Ward, G. M.; Argenzio, R. H.; Johnson, J. E. (Colorado State Univ., Fort Collins). pp 73-80 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Hydrogen isotopes have been used successfully to estimate the total body water of ruminants but for many physiological studies it also would be desirable to have estimates of extracellular water (ECW) and the relatively large volume of water found in the rumen. ^{82}Br was administered to cattle and goats to determine if this radionuclide, which is routinely used in medical research, would provide reliable estimates of ECW in ruminants and how the nuclide was distributed between ECW and rumen water. High-specific-activity ^{82}Br was administered intravenously to six cattle and two goats fitted with rumen cannulae. ^{82}Br activity reached equilibrium in blood plasma in about two hours. Equilibrium in rumen water, however, was not reached before about 24 hr. Because of the slow buildup and small percentage of dose (less than 10%) found in rumen fluid in the first few hours, the error was minimal if this fraction was ignored and ECW estimated from the plasma ^{82}Br activity 2 to 5 hours after injection. Although the ^{82}Br in rumen water equilibrates with plasma after 24 hr the kinetics do not indicate a means of making reliable estimates of this water pool. ^{82}Br entered erythrocytes and the necessary correction averaged 0.365 times the activity found in the plasma. ^{82}Br was found to reach equilibrium in milk at about 12 hr with a specific activity comparable to rumen fluid. ^{36}Cl was administered to one goat with results similar to those obtained with ^{82}Br. Seven pigs were dosed with ^{36}Cl and the average ECW estimate was 36.7% of total body weight or 21.9% of total body water. ^{36}Cl has the advantage of a longer physical half life, but ^{82}Br is generally more easily determined in plasma, rumen fluid, milk, and urine. The whole-body half-retention time for ^{82}Br was determined for one cow in a whole-body counter and found to be 14 days. (auth)

28093 RADIOIMMUNOASSAY AND COMPETITIVE PROTEIN BINDING FOR THE MEASUREMENT OF CERTAIN STEROID HORMONES IN FARM ANIMALS. Edqvist, L. E. (Royal Veterinary Coll., Stockholm); Johansson, E. D. B. pp 245-258 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Plasma progesterone determinations were made for cattle and swine using a simple petroleum ether extraction of the plasma followed by competitive protein binding. The selection of petroleum ether is crucial for the specificity, and 0.5 ml of plasma is needed for the determination during the luteal phase and during pregnancy in the bovine. For swine only 0.1 ml of plasma is needed for the determination. One technician can assay 20 samples in one day with good accuracy and with a precision of 5.4% in the most favorable range of measurement. Estimations of peripheral plasma estrone and estradiol have been carried out using a radioimmunoassay technique. The method includes ether extraction, separation of estrone and estradiol by Sephadex LH-20 column chromatography and radioimmunoassay using estradiol antibodies and tracer ^{3}H-estradiol. Dextran-coated charcoal was used to separate free and antibody-bound steroid. By omitting the chromatographic step, a simple and relatively accurate estimate of estrone in bovine peripheral plasma can be obtained. The use of competitive protein binding for the determination of testosterone and 17α-hydroxyprogesterone, as well as radioimmunoassay for the determination of progesterone, is discussed. (auth)

28094 USE OF ISOTOPES IN TURNOVER STUDIES OF VOLATILE FATTY ACIDS IN THE RUMINANT. Annison, E. F. (Unilever Research Lab., Sharnbrook, Eng.). pp 261-271 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

The microbial fermentation of food in the rumen gives rise to large amounts of acetate, propionate, and butyrate which constitute a major source of energy to the host animal. Isotope dilution techniques were used to measure the rates of production of the individual acids, their interconversions, and their metabolic fate during and after transfer through the rumen wall into portal blood. Although only small amounts of propionate and butyrate escape metabolism in the rumen wall and in the liver, most of the acetate absorbed from the rumen becomes available to extra-hepatic tissues. The relative contributions of acetate of alimentary origin, and of endogenous acetate produced during fast metabolism, may be evaluated by isotope dilution. The data obtained by isotope dilution on the production, turnover, and oxidation of volatile fatty acids in ruminants is reviewed in relation to overall metabolism, and with particular reference to the lactating animal. (auth)

28095 USE OF ISOTOPES IN STUDIES ON FLUXES ACROSS THE FORESTOMACH WALL OF RUMINANTS. Von Engelhardt, W. (Univ. of Hohenheim, Stuttgart). pp 273-284 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Methods used to study fluxes nutrient across the forestomach wall with isotopes are reviewed and some results are presented. Mainly investigations on domestic ruminants predominate, but a few on the llama are also quoted. Improved techniques in conscious animals and using isolated epithelia have been increasingly applied in recent years, whereas acute experiments with isolated reticulo-rumen by ligature of oesophagus and reticuloomasal

orifice have become less important. In animals with a rumen cannula and with minimally disturbed forestomach contents, estimations of rapid fluxes are inaccurate because of slow mixing, salivary contamination, sampling error, and metabolism of solutes. With non-absorbable, non-metabolizable, and soluble markers (PEG, ^{51}Cr-EDTA, ^{125}I-Na-diatriozoate), fluid volume, dilution rate, and passage rate to the omasum may be estimated, but it remains difficult to consider all interferences simultaneously. Advantages and limitations of procedures with temporarily isolated reticulo-rumen, temporarily isolated ventral sac of the rumen, and the isolated, innervated Pavlov-type pouch are discussed. Exact experimental control is possible in studies with isolated sheets of epithelium in diffusion chambers. In connection with the methods discussed, flux studies with HTO, ^{22}Na, ^{24}Na, ^{42}K, ^{36}Cl, ^{82}Br, and difficulties with substances that are metabolized in the epithelium (^{14}C- and ^{15}N-urea, ^{14}C-VFA, ^{14}C-aminoacids) are mentioned. Attention is given to the use of isotopes to investigate interactions and regulation of fluxes. (auth)

28096 USE OF LABELLED SUBSTANCES TO STUDY FLUXES ACROSS THE INTESTINAL WALL. Hurwitz, S. (Agricultural Research Organization, Bet Dagan, Israel). pp 285-294 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Isotopes are essential in measuring nutrient fluxes across biological membranes where movements in both directions occur simultaneously. Thus, labeled substances have been extensively used with in vitro intestinal preparations in which the system of membrane and bathing solutions is clearly defined. With some additional effort, the same system of analysis can be applied to a perfused intestine in situ. In both systems, the flux is calculated by multiplying the isotope flux by the specific activity of the solution, under defined conditions. Measurements of fluxes of nutrients in the intact animal are more complex. Classically, net absorption from the entire intestine is measured by balance techniques. The endogenous excretion and total inflow into the intestine were measured in chickens by injecting the labeled compound into the body and calculating those parameters from the amount of isotope appearing in the feces. Recently a system was devised in which the fluxes from any intestinal segment can be evaluated in the intact animal. This system involves a constant feeding of a non-absorbed reference substance, and the injection of the labeled nutrient into the body pool. Under conditions of steady state, the net absorption can be evaluated from the ratio of the nutrient to the reference substance. Inflow and outflow are then calculated from the ratios of the labeled nutrient to the reference substance and the specific activity of the nutrient in plasma and intestinal lumen. (auth)

28097 INFLUENCE OF INGESTED QUANTITY ON GASTRO-INTESTINAL TRANSIT AND DIGESTIBILITY OF A GRAMINEOUS FODDER GIVEN TO SHEEP IN BULK AND IN PELLETS. Francois, E.; Compere, R. (Faculte des Sciences Agronomiques de l'Etat, Gembloux, Belg.). pp 301-319 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972). (In French)

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

In the first of three successive experimental phases, eight sheep in metabolism cages were fed on a gramineous fodder ad libitum; in the second phase they were given pellets made from the same fodder in an amount corresponding to the bulk quantities consumed during the first phase; and finally they were given these same pellets ad libitum. The coefficients of digestibility for dry matter and cellulose were determined during each phase. The rate of transit of the digestion residues was determined at the same time by an original method already described, using two radiolanthanides (^{144}Ce, ^{144}Pr) as unabsorbed tracers. The excretion of the tracer, indicated by the changing fecal concentration, followed a simple exponential law. In this case an excretion curve characterized by only one adequate parameter, T, the period of the phenomenon, could be plotted. A close correlation was revealed between the amount consumed and the rate of transit of the digestion residues as determined by the above-mentioned method. High consumption corresponded to rapid transit and vice versa. The regression followed an exponential law. Furthermore, the coefficient of digestibility of cellulose decreased as the transit became faster. At high values of T, corresponding to slow transit times, the coefficients of digestibility of cellulose were high, and vice versa. The relation between these two variables was also exponential. Regression diagrams and equations for the various functions are presented. (auth)

28098 STUDY OF THE METABOLISM OF ^{14}C-LABELLED CHOLESTEROL IN CHICKS. Rico, A. G.; Godfrain, J. C.; Burgat Sacaze, V.; Benard, P.; Braun, J. P. (Ecole Nationale Veterinaire, Toulouse). pp 329-334 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972). (In French)

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

The metabolic study described was carried out with ^{14}C-labeled cholesterol in its C4 carbon form. Autoradiography was the technique used. Following oral administration of the cholesterol in doses of 40 μCi/kg the chicks were sacrificed at 1, 2, 6, 12, 26, 36, 48, 72, and 96 hr. The animals were frozen and 20 μm thick sections of the whole animal were prepared with a freezing microtome. The sections were dried by storage in a freezer for 15 hr and then placed on films. After exposure times varying from 4 to 20 days the films were developed and examined. It was noted in particular that there was a rapid hepatic and biliary concentration, little uptake by the muscle masses, and practically no uptake by the nerve tissues. (auth)

28099 PHYSIOLOGICAL BEHAVIOUR OF MANGANESE IN GRAVID CATTLE, SHEEP, AND SWINE. Hansard, S. L. (Univ. of Tennessee, Knoxville). pp 351-365 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Quantitation of placental transfer, rate of movement, and maternal-fetal deposition in yearling gravid cattle, sheep, and swine was provided by radiochemical procedures. Whole-body-retained manganese, as a function of gestation age and time, after dosing permitted tissue distribution, radiation-dose calculations, species differences, placental membrane permeability, and rate patterns. Results from 15 pregnant yearling sheep, 15 ewes, 12 cows, and more than 100 fetuses indicated absorbed radiomanganese traversed the placenta at all gestation ages, and species showed greater effect upon ^{54}Mn movement than did fetal age. Net manganese body retention varied from 3% for ruminants to 28% for swine. Blood disappearance of injected or ingested radiomanganese followed characteristic patterns. Beta globulin binding for ^{54}Mn transportation further suggested valence changes to functional state. The ubiquitous occurrence in the maternal-fetal body indicated a special manganese role in animal metabolism. Placental transfer rate was faster in ruminants than for swine, and calculated efficiency coefficients for compartment absorption ran higher. Third trimester ewes absorbing 8% ingested manganese, transferred 48% of that retained to total products of conception, and 51% of this to the developing fetus after seven days. Liver and placenta were the major ^{54}Mn reservoirs and dose critical organs for both dam and fetus. Maternal and fetal distribution and radioactive dose calculations were reflected by the species and placental transfer rates observed. (auth)

28100 COMBINED USE OF MULTIPHASIC SCREENING AND A WHOLE BODY COUNTER TO INVESTIGATE SODIUM METABOLISM. Payne, J. M.; Sansom, B. F.; Manston, R.; Vagg, M. J. (Agricultural Research Council, Compton, Eng.). pp 379-389 of Isotope Studies on the Physiology of Domestic Animals. Vienna; International Atomic Energy Agency (1972).

From symposium on isotope studies on the physiology of domestic animals; Athens, Greece (20 Mar 1972). See STI/PUB-309; CONF-720345-.

Multiphasic screening techniques have shown that sodium deficiency is common in cattle grazing on pastures in the United Kingdom. Analysis of the herbage reveals that over 50% of samples from various parts of the country are below the standard dietary requirements of dairy cows. The whole-body counter, in conjunction with the multiphasic screening technique, promises to be a powerful tool for the investigation of sodium metabolism in cattle. The whole-body counter allows the estimation to be made of the absorption, retention, and endogenous excretion of sodium, without the inaccuracies inherent in laborious balance determinations. Such work, which is relevant to the temperate climate of the United Kingdom, may be even more important in hot environments where there is a heavier strain on sodium metabolism. (auth)

28101 APPLICATION OF RADIOISOTOPES FOR AGRICULTURAL AND BIOLOGICAL STUDIES ON ENVIRONMENTAL POLLUTION. Takase, A. (Inst. of Public Health, Tokyo). Proc. Jap. Conf. Radioisotop.; No. 10, 504-506(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

Studies on environmental pollution using radioisotopes as tracers are reviewed. The influence of pollution of air with oxidant and waste gas from automobiles, and that of water caused by materials from factories and cities on animal bodies, plants, and agriculture has been studied. In this connection, studies on the fading of oat cotyledon by air pollution, on the absorption, distribution, and excretion of SO_2 in animal bodies, on the lesion of pulmonary tissues by waste gas, on the application of radioisotopes to measure the clearance of the respiratory system, and on the application to the bioassay of water pollution are presented. The influence of agricultural insecticides and fungicides was studied by a radioisotope tracer method. The following studies are mainly presented: absorption and decomposition of agricultural chemicals by plants, plankton, marine products, or birds using ^{14}C, ^{35}S, ^{36}Cl, and ^{203}Hg tracers; the sphere of influence of dispersed chemicals; measurement of remaining medicine; and so on. For the poisonous substances mixed in food such as As, PCB, and food additives, their absorption into animal body and excretion were elucidated. (Japan)

28102 RADIOIMMUNOASSAY OF OVINE AND BOVINE GROWTH HORMONES. Neutralization or Elimination of Antiprolactine Antibodies in Somatotropic Antihormone Immunoserums. Martal, J. (Centre National de Recherches Zootechniques, Jouy-en-Josas, France). Compt. Rend., Ser. D; 275: No. 21, 2379-2382(20 Nov 1972). (In French).

It is possible to completely avoid interventions with antiprolactin antibodies, which contaminate anti-STH immunoserums either by exhausting them with prolactin or by eliminating them by immunoadsorption. These techniques enable specific radioimmunoassays to be performed for the somatotropic hormones of ruminants from the incompletely purified hormone. The exhausting of anti-STH immunoserums with prolactin is simple and rapid. Its renewal is however, required at each assay before the distribution of the antiserums in the incubation tubes. Immunoadsorption on bromoacetylcellulose prolactin PSq requires a very pure prolactin that does not require renewal at each assay. Nevertheless, this technique involves a slight reduction in the quantity of adsorbed anti-STH immunoserum. (France)

28103 RADIOIMMUNOASSAY OF PLASMA ACTH. Vague, P.; Oliver, C. (Hopital de la Conception, Marseille). pp 351-366 of Seminar on Radioimmunoassay. Boulogne, France; Institut National de la Sante et de la Recherche Medicale (1972). (In French)

From seminar on radioimmunoassay; Paris, France (15 May 1972).

Radioimmunoassays of plasma ACTH were studied with particular attention being given to the specificity problem in relation to the fragments of the ACTH molecule that might be present in the plasma; problems arising from absorption by the walls and the degradation of the ACTH by the plasma. This assay detects quantities of less than 10 pg of ACTH per ml of 1/5 diluted plasma. It is nevertheless possible to increase the sensitivity by decreasing the ^{131}I ACTH concentration to between 1.5 and 2 pg/ml. Quantities of less than 1 pg/ml of ACTH (5 pg/ml of ACTH in 1/5 diluted plasma) then become easily detectable. (France)

28104 RADIOIMMUNOASSAY OF HUMAN THYROCALCITONIN. Moukhtar, M. S.; Jullienne, A.; Milhaud, G. (Univ. Saint-Antoine, Paris). pp 439-448 of Seminar on Radioimmunoassay. Boulogne, France; Institut National de la Sante et de la Recherche Medicale (1972). (In French)

From seminar on radioimmunoassay; Paris, France (15 May 1972).

The radioimmunoassay of thyrocalcitonin enables the normal and pathological level of this hormone to be evaluated. The most sensitive radioimmunoassay performed enabled the detection of between 0.001 and 0.004 ng; a more current, but less sensitive technique detects between 0.024 and 0.010 ng. The concentration of circulating hormone in normal subjects is 0.22 ng/ml. In different affectations, such as medullary cancer of the thyroid and carcinoids, the concentration of circulating thyrocalcitonine undergoes important modifications. The results obtained by radioimmunoassay are compared with those obtained using the biological method. (France)

28105 ASSAY OF HUMAN PLASMA RENIN ACTIVITY USING THE ANGIOTENSIN RADIOIMMUNOASSAY. Menard, J.; Corvol, P.; Allegrini, J.; Breniner, J. (Institut National de la Sante et de la Recherche Medicale, Paris). pp 459-470 of Seminar on Radioimmunoassay. Boulogne, France; Institut National de la Sante et de la Recherche Medicale (1972). (In French)

From seminar on Radioimmunoassay; Paris, France (15 May 1972).

Radioimmunoassays of angiotensin I can provide accurate results with small quantities of plasma. The plasma renin activity is determined from measurements of the quantity of angiotensin I produced under specific incubation conditions in the presence of a mixture inhibiting any conversion of angiotensin I into angiotensin II. The use of renin plasma activity measurements as a routine means of investigating high arterial blood pressure is discussed. The clinical conditions under which the samples are obtained are given together with the relevant assay specifications. (France)

28106 RADIOIMMUNOASSAY OF URINARY INSULIN. Isaac, R.; Nivez, M. P.; Paillard, F.; Ardaillou, R. (Institut National de la Sante et de la Recherche Medicale, Paris). pp 537-549 of Seminar on Radioimmunoassay. Boulogne, France; Institut National de la Sante et de la Recherche Medicale (1972). (In French)

From seminar on Radioimmunoassay; Paris, France (15 May 1972).

The application of the technique used to assay plasma insulin to urinary media is discussed. This application requires the study of various problems; inconsistency of the urinary medium, factors damaging the hormone studied, and the existence of urinary substances reacting in a nonspecific manner. Two modifications were made to the original technique: the modification of the volume ratio in the incubation tubes and the introduction of insulin-free urine belonging to the patient assayed into the standard reference range. (France)

28107 RAPID RADIOIMMUNOASSAY METHOD FOR THE DETERMINATION OF PLASMA RENIN ACTIVITY. Vincent, M.; Sassard, J.; Cier, J. F. (Univ., Lyon). Rev. Eur. Etud. Clin. Biol.; 17: No. 10, 1001-1006(Dec 1972). (In French).

A new radioimmunoassay technique for angiotensin I was developed. The technique was applied to the direct determination of plasma renin activity. After inhibiting the angiotensinases and the conversion enzyme, the quantity of angiotensine I produced during the incubation of a plasma sample depends only on the activity of the renin contained. The principal advantage of this method resides in the use of high affinity antibodies. As a result the angiotensin I can be assayed directly in the plasma without the prior extraction of the hormone and without adding plasmatic proteins to the standard curves. An increased reproducibility is thus obtained together with a greater accuracy and a simplification of the assay procedure. The very good agreement between this radioimmunoassay and bioassays gives an indication of the reliability of the method. (France)

MATERIALS

Ceramics and Cermets

Refer also to abstracts 27468, 28214, 28220, 28227, 28245, 28259, 28286, and 29380.

28108 (CEA-CONF-2111) APPLICATION OF INDUCTIVE PLASMA PULVERIZATION TO PRODUCTION OF MECHANICAL AND ELECTRONIC COMPONENTS. Daniault, J. (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 1972. 7p. (In French). (CONF-720974-1). Dep. NTIS (U. S. Sales Only).

In inductive plasma pulverization a magnetic induction coil of the material to be protected is placed in a vacuum chamber and supplied by a high-frequency generator. By the controlled admission of a gas or a gaseous mixture and under the effect of the high-frequency field, a plasma is confined at the interior of the coil. It is volatilized progressively and deposited on objects placed in the chamber. The application of this technique to Al interconnections for integrated circuits with MOS transistors, glass plates covered with Ni for electrical contacts in neutron multidetectors, coils for measurement of the diamagnetism of plasmas, deposition of stainless steel on long Cu tubes, deposition of Si and Si_3N_4, deposition of W on Cu, deposition of Dy on pyrocarbon, deposition of Al_2O_3 on Si, and deposition of corrosion protection coatings are described. Deposits of high-purity Nb on Al_2O_3 by this process are superconductors. (JSR)

28109 (DP-Report-629) MIGRATION OF URANIUM THROUGH COMPLEX COATED UO_2 PARTICLES: INTERIM REPORT. Dragon Project. Roellig, K. (Atomic Energy Establishment, Winfrith (England)). Jan 1969. 38p. Dep. NTIS (U. S. Sales Only) $4.00.

Isothermal heating experiments at high temperatures were carried out with current Dragon low-enrichment oxide fuels. The experimental data concerning the transport of uranium through the coating are evaluated with a diffusion model. The apparent diffusion coefficient of uranium through the vapor deposited SiC layer of the first prototype low enrichment oxide fuel is described by the Arrhenius relation with the frequency term: $D_0 = 6 \times 10^{-3}$ cm^2 s^{-1} and the activation energy: $E_{act} = (95 \pm 10)$ kcal/mole for temperatures between 1800 and 2200° C. The investigation results are the basis for systematization and classification of the performance of different fuel types. (auth)

28110 (EURISOTOP-55(Vol. 2), pp 1123-1136) REDUCTION OF RADIATION EXPOSURE IN X-RAY ROOMS BY MEANS OF LOW BACKSCATTER WALL CLADDING. Goettel, K. (Gesellschaft fuer Kernforschung, Neuherberg, Ger.). 1972. (In German).

From Conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

X-ray examinations, during which the examing doctor and his assistants must remain in the x-ray room, entail their exposure to radiation, which cannot be entirely avoided even by shielding and protective clothing. The main source of this exposure is the backscattered radiation from the patient and from the walls, ceiling and floor. Tests were made of the backscatter properties of various building and wall cladding materials. They showed that the quantity and quality of the backscatter is dependent not only upon the energy of the incident primary radiation but also upon the nature of the backscattering material. From the radiation protection standpoint the most suitable material for the wall or the wall cladding is the material which reflects the least and the softest radiation possible. A major reduction in the backscatter as compared with usual building materials was observed with enameled iron. The backscatter from heavy concrete is reduced to about 15% by cladding it with enameled sheet iron. Measurements made at the position occupied by the doctor during radiography showed that by cladding one wall only with a few square meters of enameled iron sheeting the radiation exposure was reduced by more than 50%. The enameled iron sheeting can be manufactured in the form of tiles of the standard size of 15 × 15 cm. They provide a durable and easily maintained wall covering which at the same time increases the wall's radiation shielding effect. (auth)

28111 (JUL-900-RW) STATIONARY AND DYNAMIC DEPOSITION OF SILICON CARBIDE ON COATED FUEL PARTICLES. Gyarmati, E.; Nickel, H. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorwerkstoffe). Nov 1972. 78p. (In German). Dep. NTIS (U. S. Sales Only) $6.00.

Silicon carbide (SiC) was deposited on fuel in loose packed particles and in the fluidized bed of monomethyltrichlorosilane (MTS). The deposition in loose packed particles led to porous compacts (loose bondings). It was found that an exact deposition at 1550°C is only achieved if the MTS is led over a section of pre-pyrolysis and the heating zone is conducted over the loose packed particles with increasing velocity. The dynamic deposition of SiC occurred in atmospheres of H_2, H_2/Ar, and H_2/N_2 at 1300 to 1700°C in a fluidized bed of 2 to 3 inches. While the efficiency strongly depends on the deposition temperature and shows a maximum at 1500°C, it was impossible to find a direct relation between the efficiency and the kind of carrier gas. The density of SiC deposited in a pure H_2 atmosphere between 1400 and 1700°C is ≥ 3.2 g/cm^{-3} and shows a maximum at 1500°C. Thus, an increasing deposition temperature and a decreasing H_2 content of the fluidizing gas have as their consequence a decrease of density. In the absence of H_2 in the fluidizing gas material similar to that of pyrocarbon (PyC), the so-called "siliconized pyrocarbon" was achieved; it reached values of density between 2.25 and 3.10 g/cm^{-3} according to the conditions of deposition. As was shown by studies on macrostructure, the SiC deposited in a pure H_2 atmosphere is always crystalline. The macrostructure becomes fine-crystalline by small amounts of Ar in the carrier gas; higher amounts of Ar produce transition structures to PyC. Nitrogen instead of Ar effects a pore-rich macrostructure. The siliconized PyC is a badly oriented material which probably contains Si in form of SiC, fine-dispersely distributed in the PyC matrix. (76 references) (auth)

28112 (JUL-Conf-6(Vol.1), pp 38-64) EFFECT OF MINOR CONSTITUENTS ON THE PROPERTIES OF VANADIUM AND NIOBIUM HYDRIDES. Reilly, J. J.; Wiswall, R. H. Jr. (Brookhaven National Lab., Upton, NY). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The stability of vanadium dihydride was found to be remarkably sensitive to small amounts of impurities. Niobium dihydride is similarly affected but to a lesser degree. For example, the dissociation pressure of $VH_{\sim 2}$ made by the high-pressure hydriding of zone-refined vanadium is 4.0 atm at 40°; but if 0.22 wt % silicon has first been added to the metal, the dissociation pressure becomes 6.8 atm. Experiment revealed that many other additives have effects of this magnitude. Results were obtained which permit comparison of the effectiveness of various added elements, and of certain combinations of additives. Also, in some cases the effect of varying the concentration of a single additive by tenfold or more was studied. It was found that VD_2 was very much more stable than VH_2. (auth)

28113 (JUL-Conf-6(Vol.1), pp 66-89) STRUCTURAL TRANSITIONS AT LOW TEMPERATURES IN VANADIUM HYDRIDES AND DEUTERIDES. Westlake, D. G.; Mueller, M. H. (Argonne National Lab., IL). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

A study using both x-ray and neutron diffraction was made of the crystal structures of V_2D and V_4D_3 at various temperatures. It was found that three phases are possible at room temperature, and a tentative phase diagram is presented. Both α and α' have a bcc metal lattice, which β has a bct metal lattice. The α' undergoes a transition to α'' at ~220°K, and α'' changes to α''' at ~160°K. Simple models for each of the phases are proposed which satisfy the neutron-diffraction data, and the transitions can be understood in terms of degree of order. (13 figures) (DLC)

28114 (JUL-CONF-6(VOL.1), pp 90-103) PHASE DIAGRAM OF NIOBIUM-HYDROGEN. Pick, M. A. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The phase diagram in the concentration range from $NbH_{0.8}$ to $NbH_{1.0}$ was studied and extended to lower temperatures. The experimental method used was mainly x-ray powder diffraction, which only shows the niobium host lattice. Therefore, several neutron-diffraction patterns were measured in order to try to localize the hydrogen. But it is only possible to perform these experiments on powder samples due to the fact that Nb single crystals, loaded with more than 0.5 atomic ratio hydrogen, do not undergo the transformation into the β phase without disintegrating. The phase diagram shows, at temperatures above 500°K, that there is an uninterrupted region in which the hydrogen is in solid solution. This region is characterized by the niobium lattice remaining bcc and the lattice parameter increasing by about 4.43×10^{-4} per 1% atomic ratio hydrogen. On cooling the system, the orthorhombic β phase with a hydrogen superlattice appears. A further, hitherto undiscovered structural transition

was found within the β phase at low temperatures. This phase was named γ phase. The metal atoms in this phase again form a bcc array. (GF)

28115 (JUL-CONF-6(VOL.1), pp 205-214) FORMATION OF INTERNAL HYDRIDES IN ALLOYS. Renner, J.; Grabke, H. J. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The isothermal equilibria and kinetics of hydrogen absorption by homogeneous Mg alloys (with Th or Ce) were studied by volumetric measurements at constant pressures between 10 to 760 torr in the temperature range 450 to 550°C. For thin samples the transfer of hydrogen atoms through the surface determines the rate of hydrogen absorption. For thicker samples of Mg alloys (diameter > 5 mm) the reaction becomes diffusion-controlled and the precipitate is formed at a reaction front advancing through the metal matrix. The internal hydriding was observed by microscopic examination of polished sections of the samples. It was possible to determine the diffusion coefficient of hydrogen in Mg. (DLC)

28116 (JUL-CONF-6(VOL.1), pp 272-283) NMR INVESTIGATION OF THE V-H AND V-D SYSTEMS. Arons, R. R.; Bohn, H. G.; Luetgemeier, H. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

An NMR study was made of the V and D resonances in V-H and V-D. Results show that: The tetrahedral β phase of V-D exists only near $VD_{0.5}$. The $\alpha-\beta$ transition occurs in $VD_{0.5}$ at ~400°K (470°K in $VH_{0.5}$). At higher concentrations in V-D, the cubic α' phase exists down to 230°K, below which the δ phase is formed. The electric field gradient for D is nearly independent of jump frequency below 180°K in the δ phase and 400°K in the β phase. Occupying of the octahedral and tetrahedral sites is discussed. (DLC)

28117 (PNCT-831-72-2) TOKAI WORKS SEMI-ANNUAL PROGRESS REPORT, JULY-DECEMBER 1971. (Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan)). Sep 1972. 91p. Dep. NTIS (U. S. Sales Only).

Research progress is reported on mixed oxide reactor fuels, mineralogy, ore processing, waste processing, fuel cladding, radiation monitoring, and uranium enrichment. (JRD)

28118 TEPLOFIZICHESKIE SVOISTVA TVERDYKH TEL PRI VYSOKIKH TEMPERATURAKH. Tom I. Trudy Vsesoyuznoi Konferentsii, Novosibirsk, 25-30 Iyulya 1966 g. (Thermophysical Properties of Solids at High Temperatures. Volume I. All-Union Conference Held at Novosibirsk, USSR, July 25-30, 1966). Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). 496p. (CONF-660733).

Volume I of the conference includes 68 papers, 19 of which are abstracted separately in this issue of NSA; the remainder were outside the NSA scope. Experimental work and instrumentation designed for special problems in high-temperature studies are described. Measurements were made in dilatometry, calorimetry, spectrometry, vaporization, vapor pressures, energies of dissociation of molecules, and thermal and electrical conductivities, and various thermodynamic properties such as enthalpy and heat capacity. The materials investigated included refractory metals such as W, Mo, Zr, Nb, Ta, their oxides and carbides, LaB_6, quartz, corundum, graphite, silicon carbide, Cs and its amalgams, alloys of Ga with Al, Sn, and Bi, and alloys of Fe, Co, and Ni. (KSW)

For abstracts of individual sections see: 28119-28129 and 28237-28244.

28119 THERMAL EMF AND ELECTROCONDUCTIVITY OF CARBIDES OF TRANSITIONAL ELEMENTS OF GROUPS IV AND V OVER THE TEMPERATURE INTERVAL 20 TO 2000°C. Golikova, O. A.; Matveeva, N. N.; Avgustinik, A. I.; Klimashin, G. M.; Kozlovskii, L. V.; Ordan'yan, S. S. pp 40-44 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The specific resistance and thermal emf of NbC_x and TiC_x were measured at 20 to 2,000°C in the regions of their homogeneity ($x < 1$). The temperature dependencies of the thermal emf and of the specific resistance for NbC_x were similar to those for TiC_x. The Hall effect in TiC_x was also studied as a function of temperature from 20 to 1,000°C. (KSW).

28120 THERMAL EXPANSION OF PARTIALLY AND COMPLETELY STABILIZED ZIRCONIUM DIOXIDE AT 1000 to 2300°C. Shakhtin, D. M.; Levintovich, E. V.; Eliseeva, G. G.; Karaulov, A. G.; Rudyak, I. N. pp 94-98 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The influence of the form and quantity of additives (6 to 12 mole %) CaO, MgO, and V_2O_3 on the thermal expansion of ZrO_2 was determined over the temperature range 1,000 to 2,300°C. Both technical grade and chemically pure ZrO_2 were used in the study, and the oxides of Ca, Mg, and V were regarded as stabilizers that tended to "fix" the ZrO_2 in the cubic structure and prevent its conversion to other modifications at 900 to 1,200°C. (KSW)

28121 DILATOMETRIC INVESTIGATION OF IRRADIATED CERAMICS. Kostyukov, N. S.; Kolotii, I. I.; Antonova, N. P. pp 106-115 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The ceramic materials microlite (Al_2O_3), GB-7 (impure Al_2O_3), 22XS (95% Al_2O_3), uralite (Al_2O_3-14% SiO_2), MG-2 (Al_2O_3-21% SiO_2), M-7 (Al_2O_3-4% SiO_2-2% CaO), SK-1 (SiO_2-29% MgO-1% Al_2O_3), SNB (SiO_2-32% MgO-13% BaO-4% Fe_2O_3-2% Al_2O_3), and M-23 (SiO_2-26% Al_2O_3-4% K_2O-2% Na_2O) were given radiation doses of 2×10^{19} and 10^{20} neutrons/cm^2. The change in linear dimensions did not exceed 0.05 and 0.75%, respectively, for the two doses; the sign of the change varied from sample to sample. The microhardness of these ceramics was measured before and after the two radiation doses; in some cases an increase, in others a decrease in hardness was observed. (KSW)

28122 USE OF A CALORIMETER FOR MEASURING THE ENERGY ACCUMULATED BY IONIC CRYSTALS DURING IRRADIATION. Zavadovskaya, E. K.; Timoshenko, N. M. pp 130-134 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

A calorimetric device was arranged so as to measure the stored energy in crystals by differential thermal analysis. Crystals of CaF_2, SrF_2 and BaF_2 were given a dose of 6.25×10^7 R of γ-radiation (source not specified) and then heated to release the energy. Spectra of the rate of energy release as a function of temperature were obtained. CaF_2 crystals stored energy more efficiently than SrF_2 or BaF_2, and SrF_2 more efficiently than BaF_2. (KSW)

28123 THERMODYNAMIC PROPERTIES OF LANTHANUM HEXABORIDE AND FORSTERITE AT HIGH TEMPERATURES. Kapyrina, V. Ya.; Prilepskii, V. N.; Timofeev, V. A.; Rimofeeva, E. N.; Trubitsyn, A. Ya.; Frolov, A. S. pp 165-169 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The heat capacities and enthalpies of LaB_6 and of forsterite (Mg_2SiO_4) were determined at 1,100 to 2,100°K by the calorimetric method. For LaB_6, $H_T - H_{298.15°K} = 0.49\ T + 16.15 \times 10^{-5}\ T^2 - 1997.2\ T^{-1} - 152.11$ joules/kg, $c_p = 0.49 + 32.30 \times 10^{-5}\ T + 1997.2\ T^{-2}$ kjoules/kg · degree. For forsterite (up to 1,900°K), $H_T - H_{298.15°K} = 0.832\ T + 1.82 \times 10^{-4}\ T^2 - 2.1 \times 10^{-9}\ T^3 - 205.2$ kjoules/kg, and $c_p = 0.832 + 3.64 \times 10^{-4}\ T - 6.3 \times 10^{-8}\ T^2$ kjoules/kg · degree. Additional equations are valid from 1,900°K to the melting point. (KSW)

28124 PHYSICOCHEMICAL CONVERSIONS OF SOME OXIDES AND CARBIDES OF REFRACTORY METALS IN A PLASMA JET. Tsvetkov, Yu. V.; Chizhikov, D. M.; Panfilov, S. A.; Tagirov, I. K.; Deineka, S. S.; Basieva, I. Ya. pp 178-187 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter

at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The behavior of the oxides and carbides of W, Mo, Nb, and Ta when introduced into the jet of a gaseous plasma was determined by the temperature of the gas, the cross-section gradient of the temperature with respect to the axis of the jet, the discharge velocity of the jet, and the heat- and mass-exchange conditions inherent in the system. Other variables discussed were the physical and chemical properties of the material being tested, its particle form and dimensions, its concentration and distribution in the jet, and its residence period within the jet. An analysis of the influence of a majority of factors was practically impossible without a model simulation approach and a number of complex thermophysical calculations requiring the services of a computer. (tr-auth)

28125 VAPORIZATION AND THERMODYNAMIC PROPERTIES OF REFRACTORY COMPOUNDS. Fesenko, V. V.; Bolgar, A. S.; Gordienko, S. P.; Guseva, E. A.; Ryklis, E. A.; Turchanin, A. G. pp 207-216 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

Vaporization data were obtained on the hexaborides of La, Ce, Nd, Sm, Gd, and Tb at temperatures in the neighborhood of 2000°K. The dissociation which accompanied the vaporization: MeB_6 (s) → Me (g) − 6 B (s), was investigated in the case of LaB_6 by the effusion method, yielding $\Delta H^{\circ}_{2150} = 134$ kcal. The vaporization of the nitrides of B, Al, and Ga, and of the carbides TiC, ZrC, HfC, $NbC_{0.77}$ and $TaC_{0.71}$ was studied over various ranges of elevated temperatures. (KSW)

28126 THERMAL STABILITY OF ZIRCONIUM DIOXIDE-BASED CERAMICS AT HIGH TEMPERATURES AS DERIVED FROM THERMOPHYSICAL MECHANICAL PROPERTIES. Prantskyavichyus, G. A.; Dauknis, V. I.; Martinaitene, V. I.; Stukonis, K. K.; Yurenas, V. L. pp 364-371 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

Thermophysical properties and heat stability indices were determined for porous ZrO_2 of different grain compositions after heating to 2,300°K. The theory of maximum stress for calculating thermal conditions of disintegration is not applicable to porous materials with minute cracks in their structures. The usual indices of thermal strength, when calculated from thermophysical properties and strength limits, do not satisfactorily characterize the heat stability of porous ZrO_2 above 1,500°K. (tr-auth)

28127 ENTHALPY AND HEAT CAPACITY OF MAGNESIUM OXIDE AND ZIRCONIUM OXIDE IN THE TEMPERATURE RANGE 1200 TO 2500°K. Kantor, P. B.; Fomichev, E. N. pp 406-408 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The enthalpies and heat capacities of MgO and ZrO_2 were measured at 1180 to 2508°K using a high-temperature calorimeter. The change in enthalpy of MgO could be described by the equation: $H_T - H_{298.15} = 10.58\ T + 0.83 \times 10^{-3}\ T^2 + 1.5 \times 10^5\ T^{-1} - 3{,}944$ cal/mole. The change in enthalpy for ZrO_2 is not represented by an equation but is presented in tabular form. (KSW)

28128 MASS SPECTROMETER FOR STUDYING THE VAPORIZATION OF RELATIVELY NONVOLATILE SUBSTANCES. Ganichev, A. A.; Il'ina, G. G.; Rutgaizer, Yu. S.; Shereshevskii, A. M. pp 429-435 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

A type MX-1308 mass spectrometer adapted for studying the vaporization processes of nonvolatile substances is described. The apparatus was used to measure the vapor pressure of LaO as a function of temperature, and to determine the mass spectra of Ag and ZrO_2, and the ionization potentials of Ag, ThO, and ThO_2. (KSW)

28129 GASEOUS EROSION OF ZIRCONIUM DIOXIDE. Mayauskas, I. S.; Grinyute, G. A.; Abraitis, R. I.; Peras, A. Ya.; Yanulis, V. V. pp 436-441 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

A current of gas at 2530°K with a velocity of 360 to 730 m/sec caused significant erosion of ZrO_2, involving a considerable depth of material and possessing a selective character. Mechanical entrainment of individual, weakly bound grains and particles was a determining factor, particularly in the early stages of erosion. Changes in the structure and chemical composition may lead to significant changes in the electrical and thermal conductivity. (tr-auth)

28130 ELECTRON MICROSCOPY AND STRUCTURE OF MATERIALS. Proceedings of the Fifth International Materials Symposium Held at Berkeley, California, September 13−17, 1971. Thomas, G. (ed.). Berkeley and Los Angeles, CA; University of California Press (1972). 1304p. (CONF-710916--). $28.50.

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971).

Seventy-nine papers were presented at the symposium. Four papers were previously abstracted in NSA as 26: 529, 26: 570, 26: 571, and 26: 16789. A separate abstract was prepared for each of 25 papers. The remaining 50 papers were not in the scope of NSA. (JRD)

For abstracts of individual papers see: 28131−28142, 28228−28236, and 28267−28270.

28131 n-BEAM LATTICE IMAGES OF COMPLEX OXIDES. Allpress, J. G.; Sanders, J. V. (CSIRO, Melbourne). pp 134-161 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The application of electron optical techniques to the study of so-called "solid solutions" of WO_3 and TiO_2 in Nb_2O_5 is described. These systems contain a family of phases with closely related structures, which can form coherent intergrowths at the unit cell level. The intergrowths, whether ordered or disordered, can be observed directly using lattice-imaging techniques. In order to relate details of the image contrast to structural features, theoretical one-dimensional images of the ordered phases $W_4Nb_{26}O_{77}$ and $TiNb_{24}O_{62}$ were computed, using n-beam dynamical theory, and compared with through-focal series of micrographs of thin crystals. The influence of instrumental factors such as aberrations and beam divergence is discussed. It is shown that structure can be directly resolved in out-of-focus lattice images. (auth)

28132 SIMULATION OF ELECTRON-TRANSMISSION IMAGES OF CRYSTALS CONTAINING RANDOM AND PERIODIC ARRAYS OF COHERENCY STRAIN CENTERS. Fillingham, P. J. (Stevens Inst. of Tech., Hoboken, NJ); Leamy, H. J.; Tanner, L. E. pp 163-170 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The strain-contrast effects to be expected in transmission electron micrographs of cubic crystals containing large volume fractions of small coherent particles have been examined theoretically. It is assumed in the calculations that: (a) coherency strain fields are reasonably well approximated by the field of an infinitesimal dislocation loop in an isotropic medium, (b) two beam diffracting conditions are satisfied, and (c) specimen surface relaxation effects may be neglected. The particle distributions examined include a fully random array, two cubic ordered arrays, and one two-dimensional ordered array. The results of these computations suggest that striated micrographs may be expected from elastically isotropic crystals containing dense nonrandom arrays of precipitate particles. Images computed for the two-dimensional array possess the contrast features observed experimentally. The three-dimensional arrays exhibit striation patterns that are similar to each other but differ from that observed experimentally. (auth)

28133 ANALYTICAL METHODS IN PHOTOEMISSION ELECTRON MICROSCOPY. Wegmann, L. (Balzers AG, Liechtenstein).

pp 246-258 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

It is noted that use of Photoemission Electron Microscopes offer new possibilities for surface quantitative analysis with submicroscopic resolution because of contrast phenomena related to work functions and depth of information related to penetration depth of electrons returning to the surface and escaping. Uses and performance of these instrument systems are described. (JRD)

28134 CRYSTALLOGRAPHIC ASPECTS OF SCANNING ELECTRON MICROSCOPY: THE ELECTRON-CHANNELING PATTERN TECHNIQUE. Schulson, E. M. (Atomic Energy of Canada Ltd., Chalk River, Ont.). pp 286-300 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Electron channeling in crystals has recently become important in scanning electron microscopy. The effect gives rise to orientation-dependent patterns from bulk crystals of the material being examined. Patterns can be instantaneously generated from areas as large as 5 mm^2 using a standard scanning-beam technique and from selected areas as small as 2 μm in dia using a specially developed rocking-beam technique. The SEM electron channeling pattern techniques as presently developed are reviewed. (auth)

28135 MICROMECHANISMS OF FRACTURE IN A W–5% Fe–5% Ni POWDER COMPOSITE. Brandon, D. C. (Technion-Israel Inst. of Tech., Haifa); Ariel, E.; Barta, J. pp 849-858 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Liquid-phase sintered W–5% Fe–5% Ni powder composites were fractured in tension and fracture surfaces examined by scanning electron microscopy. Topographical features of the fracture surface were correlated with the observed mechanical properties, in particular the fracture stress and fracture strain. Optimum properties were associated with a uniform distribution of tungsten particles in a continuous ductile matrix phase. The dominant fracture modes were grain boundary failure at the junction between tungsten particles and shear failure of the matrix phase. (auth)

28136 GROWTH AND CHARACTERIZATION OF REFRACTORY OXIDE–METAL COMPOSITES. Gerdes, R. J.; Chapman, A. T. (Georgia Inst. of Tech., Atlanta). pp 859-869 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Unidirectional solidification of refractory oxide–metal composites has led to a novel class of composites. In these composites the metal grows in the form of well-ordered fibers or platelets imbedded in an oxide matrix. The combination of UO_2 or ZrO_2 with W has been found to be especially suited for composite growth experiments. But growth is not restricted to one or two oxide–metal combinations. Melt experiments with Cr_2O_3, NiO, TiO_2, and even Y_2O_3 show some promise. The composite growth morphology, orientational relationships, and etching behavior have been analyzed and characterized by x-ray-diffraction techniques and, in particular, scanning electron microscopy. Simple orientations with close-packed planes normal to the growth direction have been found to prevail in the composite materials. Etching of composite specimens produces tungsten fiber shapes which can be explained on the basis of thermodynamic equilibrium growth forms for W and UO_2. Results are given only for Ti–TiO_2 and W–UO_2 composites. (auth)

28137 MULTIPLE FRACTURES IN FILAMENT-REINFORCED COMPOSITES. Kerhuel, G. R.; Bragg, R. H. (Univ. of California, Berkeley). pp 870-877 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The fracture behavior of boron–aluminum composites was investigated. It was observed that the entire gage length of the tensile specimens shatters at fracture, and a series of parallel fractures was obtained. This phenomenon was found to depend on the geometry of the cross section of the specimen. Though few experimental results are available presently, it is believed that "secondary" fractures result from local compression due to dispersion of the unloading stress wave emitted during the first or "initial" fracture. Such fracture behavior should be observable with other brittle elastic and dispersive materials. (auth)

28138 CHARACTERIZATION OF IRRADIATED CERAMIC OXIDE NUCLEAR FUELS. Rosenbaum, H. S.; Wolff, U. E.; Lannin, T. E. (General Electric Co., Pleasanton, CA). pp 1017-1026 of Electron Microscopy and Structure of Materials. Thomas, G. (ed). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Methods of characterizing radiation effects on ceramic nuclear fuels are reviewed, emphasizing techniques that utilize electron beams. Information is included on replication electron microscopy, transmission electron microscopy, scanning electron microscopy, and electron-probe microanalysis. (JRD)

28139 STRUCTURE OF VAPOR-DEPOSITED 4D TRANSITION METALS. Loop, R.; Collver, M.; Hammond, R. (Univ. of California, Berkeley). pp 1074-1083 of Electron Microscopy and Structure of Materials. Thomas, G. (ed). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The structures of electron-beam-evaporated 4d-transition metals, condensed on a helium-cooled substrate, were observed with an electron microscope. The samples were annealed to room temperature and removed from the substrate prior to the examination. The elements observed were in the range from zirconium to ruthenium, with the samples consisting of pure elements and various binary alloys. Compositions of Nb–Zr, Mo–Zr, and Mo–Ru falling in two phase regions were found to have an amorphous structure as deposited, which remained stable up to and through room temperature. Pure elements and solid solution alloys of these systems and of Nb–Mo with the exception of close-packed metals were also deposited in the amorphous state, with the transformation to the stable structure occurring well below room temperature in most cases. (auth)

28140 NONSTOICHIOMETRY IN CERAMIC COMPOUNDS. Lewis, M. H.; Billingham, J.; Bell, P. S. (Univ. of Warwick, Coventry, Eng.). pp 1084-1115 of Electron Microscopy and Structure of Materials. Thomas, G. (ed). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

An electron-microscopic and diffraction study was made of phase structures and transformations in selected compounds of group IV and V transition metals with carbon or nitrogen. These techniques are particularly suitable for detecting and analyzing the mechanisms for order–disorder transformations that occur frequently in the carbides. The transformations involve rearrangements of carbon atoms that do not completely occupy octahedral sites in the metal atom substructure. A brief discussion is given of the possible influence of these transformations on mechanical properties of selected compounds. (auth)

28141 PRECIPITATION IN BORON-DOPED VANADIUM CARBIDE. Hollox, G. E.; Rowcliffe, D. J. (Brown Boveri Research Centre, Baden, Switzerland). pp 1116-1130 of Electron Microscopy and Structure of Materials. Thomas, G. (ed). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

An electron-microscope study of vanadium carbide single crystals doped with boron is reported. Planar precipitates showing fringe contrast were observed on {111} and {100} habit planes.

Computer-simulated electron images were derived and compared with experimental images obtained under different diffracting conditions. Matching of the actual and computed images enabled the displacement vectors and the Burgers vectors of the partial dislocations to be determined. The defects on {111} appear as intrinsic faults surrounded by Shockley partials with Burgers vector a/6 [2$\bar{1}$1]. The defects on {100} appear as extrinsic faults, the surrounding dislocation having a Burgers vector a/6 [100]. (auth)

28142 PLASTIC DEFORMATION OF TANTALUM CARBIDE UP TO 2200°C. Martin, J. L.; Lacour-Gayet, P.; Costa, P. (Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France). pp 1131-1140 of Electron Microscopy and Structure of Materials. Thomas, G. (ed). Berkeley and Los Angeles, CA; Univ. of California Press (1972). See CONF-710916.

Bending experiments were performed on thin sheets of TaC_{1-x} together with electron-microscope observations. These observations revealed dislocation splitting in TaC_{1-x}, the stacking-fault energy of the carbide increasing when x decreases. Results of the bending tests were analyzed in terms of a strain rate law of the type: $\dot{\epsilon} = A(\sigma - \sigma_i) \exp(\sigma - \sigma_i/kT\ V) \exp(-\Delta U/kT)$ and interpreted on the basis of a model of carbon-diffusion-assisted glide of dislocations. (auth)

28143 PHYSICAL CHEMISTRY, SERIES ONE. Volume 10. Thermochemistry and Thermodynamics. Skinner, H. A. (ed.). MTP Internal Review of Science. Baltimore; University Park Press (1972). 265p. $24.50.

Developments in the experimental science of chemical thermodynamics are reviewed in eight chapters. A separate abstract was prepared for each of two chapters. The other six chapters are not in the scope of NSA. (JRD)

For abstracts of individual chapters see: 28144 and 28145.

28144 CRITICALLY EVALUATED TABLES OF THERMODYNAMIC DATA. Zwolinski, B. J.; Chao, J. (Texas A and M Univ., College Station). pp 93-120 of Physical Chemistry, Series One. Vol. 10. Skinner, H. A. (ed.). Baltimore; University Park Press (1972).

International sources of compiled physico-chemical and thermodynamic properties of pure substances and mixtures are listed and discussed. Information is included on sources of thermodynamic data, evaluation of thermochemical data, and computer processing of thermodynamic data. (45 references) (JRD)

28145 EQUILIBRIUM STUDIES AT HIGH TEMPERATURES. de Maria, G.; Balducci, G. (Univ., Rome). pp 209-230 of Physical Chemistry, Series One. Vol. 10. Skinner, H. A. (ed.). Baltimore; University Park Press (1972).

Results of studies of condensed phase-gas phase equilibria of organic materials are presented. Information is included on homonuclear molecules, heteronuclear molecules, halides, oxides, carbides, sulfides, selenides, tellurides, nitrides, and borides. (JRD)

28146 CONCENTRATION PROFILES THROUGH THIN OXIDE SCALES BY ION-PROBE MICROANALYSIS. Wright, I. G.; Seltzer, M. S. (Battelle-Columbus Labs., OH). Met. Trans.; 4: No. 2, 411-417(Feb 1973).

The ion microanalyzer was used to measure concentration profiles through oxide scales formed on oxide dispersion-containing Ni-20 wt % Cr alloys after high-temperature oxidation. These protective scales are sufficiently thin, generally less than 1.0 μm, to render examination by more established techniques such as electron-probe microanalysis difficult and often fruitless. The operation of the technique is described and the results obtained are discussed. Although the analyses are not yet quantitative, the profiles obtained indicate that the dispersoid is incorporated throughout the whole thickness of the scales, and allow further insight into the mechanism of oxidation of these alloys. (auth)

28147 PHYSICAL CHEMISTRY, SERIES ONE. Volume 11. Chemical Crystallography. Robertson, J. M. (ed.). MTP International Review of Science. Baltimore; University Park Press (1972). 352p. $24.50.

Data and information related to chemical crystallography are presented. Chapters are included on hydrogen bonding, structural chemistry, crystal structures, solid phase transformations, structures of large molecules, protein crystallography, x-ray crystallography, and structures of natural products. (JRD)

28148 SYSTEMS $WO_3-R_2O_3$(R = Ga OR In). Karpov, V. N.; Korotkevich, I. B. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 18: No. 2, 570-571(Feb 1973). (In Russian).

Eutectic compositions were shown to exist in the systems $WO_3-Ga_2O_3$ (1180°C) and $WO_3-In_2(WO_4)_3$ (1250°C) by means of differential thermal and x-ray analyses. The compound $In_2(WO_4)_3$ melted incongruently at 1410°C and possessed a reversed polymorphic transformation at 255°C. (KSW)

28149 EFFECT OF SHOCK WAVES ON TANTALUM PENTOXIDE. Breusov, O. N.; Dremin, A. N.; Drobyshev, V. N.; Pershin, S. V. Zh. Neorg. Khim.; 18: No. 2, 295-299(Feb 1973). (In Russian).

In experiments on shock compression of Ta_2O_5 two modifications were used: low-temperature β-Ta_2O_5 (orthorhombic) and high-temperature α-Ta_2O_5 (tetragonal). These two modifications were subjected to the shock compression wave originating in the detonation of an explosive substance (hexogen, cyclonite), and then were investigated by x-ray diffraction, pycnometry, and analysis for the oxygen content. No change in the β-Ta_2O_5 crystalline structure was wrought by the shock treatment. In contrast, α-Ta_2O_5 was converted to β-Ta_2O_5. The use or another explosive (40/60 TNT/cyclonite) with an even higher detonation rate, a tetragonal lattice with the formula $Ta_{0.83}O_2$ was formed. (KSW)

28150 REACTION OF YTTRIUM OXIDE WITH THE SESQUIOXIDES OF TITANIUM AND VANADIUM. Shveikin, G. P.; Bazuev, G. V. Zh. Neorg. Khim.; 18: No. 2, 291-294(Feb 1973). (In Russian).

The chemical compounds $YTiO_3$ and YVO_3 were formed at 1500 to 1700°C in mixtures of $Y_2O_3-Ti_2O_3$ and $Y_2O_3-V_2O_3$. X-ray powder-diffraction patterns of the two orthorhombic compounds established lattice parameters for $YTiO_3$: a = 5.327, b = 5.618, c = 7.591 Å, and for YVO_3: a = 5.271, b = 5.574, c = 7.556 Å. (tr-auth)

28151 EVAPORATORS FROM HIGH-MELTING COMPOUNDS FOR VACUUM METAL DEPOSITION. Bukowiecki, J. Rudy Metale Niezelaz.; 17: No. 11, 527-534(Nov 1972). (In Polish).

Properties of carbides and borides of high-melting metals essential for the application of these compounds in vacuum metal evaporators for thin-metallic-layer deposition were investigated. Based on the data presented it was established that, for periodic evaporation, the most useful were evaporators made of TiC, ZrC, TiB_2, and TaC; for producing metallic deposits of high chemical purity HfC and NbC types; for continuous evaporation, types made of TaC, WC, and TiB_2. It was proved that the presence of pores in the evaporator material gives rise to both desirable and adverse effects during liquid metal vacuum evaporation. (auth)

28152 CRYSTAL STRUCTURE OF THE COMPOUNDS TaCoB AND $NbCoB_2$. Kuz'ma, Yu. B.; Rudakevich, O. M. (Lvov State Univ.). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 2, 164-167(1973). (In Ukrainian).

Methods of x-ray analysis (Laue, rotation, reciprocal lattice photography, powder) made it possible to establish that the ternary compound TaCoB has the NbCoB-type crystalline structure (space group $Pmmn-D_h^{13}$, a = 3.259 + 0.002, b = 17.07 + 0.01, c = 5.920 + 0.004 Å). The first step carried out was determining the crystal structure of the ternary compound $NbCoB_2$ of rhombic form obtained earlier; a = 6.057 + 0.005, b = 3.127 + 0.003, c = 8.215 + 0.010 Å, diffraction symbol $mmmPna^-$. (auth)

28153 HIGH-TEMPERATURE CREEP OF ZIRCONIUM CARBIDE. Miloserdin, Yu. V.; Naboychenko, K. V.; Cheburkov, V. I.; Naumov, S. G.; Laveykin, L. I.; Bortsov, A. G. Probl. Proch. Mashinostr.; No. 3, 50-53(Mar 1972). (In Russian).

Experiments on creep and protracted strength were conducted on zirconium carbide samples in the temperature range 2,450 to 2,810°K. The behavior of zirconium carbide at various stages of creep was examined, and the role of previous history of the samples is discussed. At stresses of from 0.3 to 1.0 kg/mm^2, creep behavior was determined by a diffusion process with an energy of activation of 116 kcal/mole. (tr-auth)

28154 MICROSTRUCTURAL OBSERVATIONS OF ARC WELDED BORON–ALUMINUM COMPOSITES. Kennedy, J. R. (Grumman Aerospace Corp., Bethpage, NY). Weld. J. (N.Y.); 52: No. 3, 120-s-124-s(Mar 1973).

Welding studies were conducted on boron-aluminum (B/Al) composites to observe the effects of gas tungsten-arc welding on the boron reinforcing filaments and aluminum matrix. The objective of this investigation was to determine the basic potential of arc welding B/Al composites for possible structural applications. Microstructural observations after welding revealed matrix fusion without apparent boron filament damage. Analysis of weld metal regions indicated that aluminum filler metal additions intermixed with the matrix and altered its chemical composition. It is concluded that arc welding of B/Al composites may be possible by control of welding energy input. (auth)

28155 SUBSOLIDUS EQUILIBRIA IN THE SYSTEM BaO–CeO_2–TiO_2. Guha, J. P.; Kolar, D. (Univ. of Ljubljana, Yugoslavia). J. Amer. Ceram. Soc.; 56: No. 1, 5-6(Jan 1973).

Subsolidus phase relations in the system BaO–CeO_2–TiO_2 were investigated using x-ray powder diffraction. The existence of the binary compound $CeTi_2O_6$ was confirmed, and its limited stability was studied before the ternary system was investigated. Six compatibility triangles were established in the ternary system at 1200°C. No ternary compound was detected. Extensive mutual solid solubility was observed between $BaTiO_3$ and $BaCeO_3$, whereas little or no solid solubility occurred between the other compounds in the system. The effects of small additions of CeO_2 on the tetragonal → cubic and cubic → hexagonal transition temperatures of $BaTiO_3$ were investigated. (auth)

28156 GAS SOLUBILITY IN RELATION TO THE STRUCTURES OF GLASSES AND LIQUIDS. Faile, S. P.; Roy, D. M. (Pennsylvania State Univ., University Park). J. Amer. Ceram. Soc.; 56: No. 1, 12-16(Jan 1973).

Alkali borate and B_2O_3 glasses containing large concentrations of gaseous noncondensed compounds (including Ar and H_2) were synthesized at high temperatures and pressures; the solubilities of the gases were determined. These materials quenched from the liquid state had glass networks with densities lower than those typical of normal glasses not containing such gases. This result is consistent with dilution in the liquid state, where the gas dissolves by generating space for itself in the melt rather than by filling interstices. For Henry's law to be obeyed, as it was in the present work, the gas could not fill large interstices only, since high pressures (up to 9 kbars) tend to destroy these interstices. The solubility data obtained are consistent with the trends predicted by a simplified theory that makes use of the surface tensions of the liquids and the molecular sizes of the gases in a system. (auth)

28157 STRENGTH OF PYROLYTIC SiC COATINGS OF FUEL PARTICLES FOR HIGH-TEMPERATURE GAS-COOLED REACTORS. Evans, A. G.; Padgett, C.; Davidge, R. W. (Atomic Energy Research Establishment, Harwell, Eng.). J. Amer. Ceram. Soc.; 56: No. 1, 36-41(Jan 1973).

Methods for measuring the strength of a hemispherical shell were developed and applied to SiC coatings obtained from reactor fuel particles. These methods allow independent evaluation of the strengths of the inner and outer layers of the coatings. The applied loads are related to the maximum tensile stress using strain-analysis techniques. Coatings from standard SiC fuel particles have a median outer-surface strength of 620 MN m^{-2} and a median inner-surface strength of 720 MN m^{-2}. These strengths relate only to a small region of the tested hemisphere, and statistical analysis is used to obtain strengths for complete spherical shells under internal pressure, the condition relevant to reactor performance. This procedure reduces the median working strength to 105 MN m^{-2}, with failure occurring preferentially from the outer surface. A second statistical analysis shows that the critical failure stress for 1 particle in 10^4 (the reactor design requirement) is 22 MN m^{-2}. A fracture-mechanics analysis of strength indicates that failure occurs by the extension of inherent flaws at the surface. These flaws are associated with surface roughness. Strength was substantially improved by reducing this roughness by controlling the conditions of deposition of the coating and the topography of the underlying pyrocarbon layer. Greatly superior coatings were thus prepared; their median failure stress under internal pressure was 560 MN m^{-2} and the 1-in-10^4 failure stress 195 MN m^{-2}. (auth)

28158 THERMAL EXPANSION OF TiB_2. Skaar, E. C.; Croft, W. J. (Army Materials and Mechanics Research Center, Watertown, MA). J. Amer. Ceram. Soc.; 56: No. 1, 45(Jan 1973).

Calculated thermal expansion coefficients for TiB_2 at 25 to 1200°C are presented. The values were obtained from x-ray powder diffraction measurements of the unit cell size as a function of temperature. (JRD)

28159 EQUILIBRIUM OXYGEN POTENTIAL–COMPOSITION RELATIONS IN $U_{0.75}Pu_{0.25}O_{2-x}$. Woodley, R. E. (Hanford Engineering Development Lab., Richland, WA). J. Amer. Ceram. Soc.; 56: No. 3, 116-119(Mar 1973).

Variations in the composition of $U_{0.75}Pu_{0.25}O_{2-x}$ as a function of the oxygen potential were determined by a thermogravimetric technique over the interval 950 to 1400°C. Oxygen potentials ranging from –100 to –155 kcal/mol were established by means of H_2O–H_2–O_2 equilibria. The partial molar enthalpy and entropy of solution of O_2 in the mixed oxide fuel were independent of temperature over the interval investigated but varied with the composition of the fuel. (auth)

28160 OXIDATION PROPERTIES OF $(U,Pu)O_2$ SOLID SOLUTIONS. Tennery, V. J.; Godfrey, T. G. (Oak Ridge National Lab., TN). J. Amer. Ceram. Soc.; 56: No. 3, 129-133(Mar 1973).

Air oxidation of $(U,Pu)O_2$ solid solutions having Pu/(U + Pu) ratios of 0.2 and 0.25 was studied using a recording thermal balance. For Pu/(U + Pu) = 0.2, the original fluorite MO_2 phase oxidized first to tetragonal M_3O_7; further oxidation at 450°C < T < 600°C gave a two-phase mixture of M_3O_8 and a cubic phase having $a_0 \simeq 5.43$ Å. Kinetic analysis of these oxidation stages indicated that the Erofeev nucleation model explains the data reasonably well, with $\Delta H \simeq 10$ kcal/mol for the formation of M_3O_7 and $\Delta H \simeq 40$ kcal/mol for the oxidation of M_3O_7 to M_3O_8 + the cubic phase. Oxidation above M_3O_7 (O/M = 2.35) resulted in mechanical disintegration of the samples because of the presence of the M_3O_8 phase. For Pu/(U + Pu) = 0.25, both isothermal and programmed air oxidation of homogeneous samples up to 800°C led to a compound with a maximum O/M ≃ 2.35, i.e., $M_4O_{9.4}$, an fcc phase having $a_0 = 5.428$ Å; these samples were not converted to powder by the oxidation. (auth)

28161 OPTICAL ABSORBANCE AND FLUORESCENCE IN PURE AND DOPED ThO_2. Harvey, P. J.; Childs, B. G.; Moerman, J. (Chalk River Nuclear Labs., Ont.). J. Amer. Ceram. Soc.; 56: No. 3, 134-136(Mar 1973).

Fluorescence spectra resulting from uv excitation of pure, Ca^{2+}-doped, and Y^{3+}-doped ThO_2 were resolved into discrete bands at 395.4, 434.6, and 464.0 nm. These bands are related to absorption bands in the pure material at 238.9, 227.3, and 252.8 nm, respectively. The Ca^{2+}- and Y^{3+}-doped ThO_2 specimens showed an apparent absorption edge at 240 nm (213 nm is the true edge in pure ThO_2). However, the fluorescence studies showed that this edge is, in fact, spurious, resulting from enhancement of the high-energy absorbance bands by doping. (auth)

28162 THIRD-POWER STRESS DEPENDENCE IN CREEP OF POLYCRYSTALLINE NONMETALS. Cannon, W. R.; Sherby, O. D. (Stanford Univ., CA). J. Amer. Ceram. Soc.; 56: No. 3, 157-160(Mar 1973).

Published results on the high-temperature creep of polycrystalline nonmetals indicate that, under high stresses, many of them obey the equation $\dot{\epsilon} \propto \sigma^n$, where $\dot{\epsilon}$ is the steady-state creep rate, σ the applied stress, and n a constant which is usually either 3 or 5. A fifth-power stress dependence is observed in most pure metals; the creep rate is thought to be controlled by a slip creep process involving dislocation climb. Third-power dependence is not merely a combination of fifth-power-dependent slip creep and first-power-dependent Nabarro-Herring creep but appears to be controlled by a separate mechanism. This mechanism may be associated with Nabarro's dislocation climb model or with Weertman's microcreep model involving charged dislocations. It appears that the ratio of the anion radius to the cation radius is usually >2 in nonmetals for which n = 3 and <2 in those for which n = 5. (auth)

28163 MODEL FOR THE DEFORMATION OF HYPER-STOICHIOMETRIC UO_2. Yust, C. S.; McHargue, C. J. (Oak Ridge National Lab., TN). J. Amer. Ceram. Soc.; 56: No. 3, 161-164(Mar 1973).

The results of deformation studies of stoichiometric and hyperstoichiometric uranium dioxide single crystals are briefly reviewed. The observed differences in slip system and dislocation substructure are rationalized in terms of a proposed model for the deformation of hyperstoichiometric single crystals. (auth)

28164 RADIATION-INDUCED CREEP OF UO_2. Solomon, A. A. (Argonne National Lab., IL). J. Amer. Ceram. Soc.; 56: No. 3, 164-171(Mar 1973).

In-reactor creep tests were performed on stoichiometric UO_2 helices enriched with 1.82% ^{235}U at fission rates of 2×10^{12} to 1.5×10^{13} fissions/cm^3-s and outer-fiber shear stresses of 2890 and 2090 psi. Depending on the test procedure, the initial creep transient either decelerated continuously or was of the sigmoidal type; this difference is rationalized in terms of the radiation-produced substructure. For constant substructure, however, strain rate was linearly proportional to fission rate. Strain recovery was also observed when the specimens were unloaded and then irradiated. Postirradiation creep tests conducted at zero fission rate showed that fission events are required for either creep or strain recovery to occur. Incremental-temperature-change experiments and normalized strain-rate-vs-temperature plots verified that the deformation was athermal at T ≤ 200°C. Postirradiation examination showed that 0.01% strain was recovered after a specimen was fractured and irradiated, but no measurable swelling, changes in density, grain size, or

stoichiometry had occurred. No evidence of microfracture was observed on ceramographic sections. A model for radiation-induced creep is proposed in which Frank loops and dislocations absorb interstitials produced locally by the fission spike and move with the aid of the localized thermal energy of the spike. (auth)

28165 DENSIFICATION AND WEAR RESISTANCE OF HfN–ZrB_2 COMPOSITIONS. Murata, Y. (Carborundum Co., Niagara Falls, NY). Amer. Ceram. Soc. Bull.; 52: No. 3, 255-259(Mar 1973).

Rates of densification, mechanical properties, microstructure, and wear resistance of hot-pressed HfN-ZrB_2 bodies were examined as a function of ZrB_2 concentration up to 60 wt. %. The maximum wear resistance expressed in terms of tool life obtained from cutting tests occurs at the composition corresponding to 80% HfN · 20% ZrB_2. Zirconium diboride is an effective grain growth inhibitor for hot-pressed hafnium nitride, the minimum grain size being ≈4 μm at 20% ZrB_2. Phases developed in the HfN-ZrB_2 bodies pressed at 2100°C were cubic (Hf, Zr) (N, B) and hexagonal (Zr, Hf) (B, N)$_2$ type solid solutions. An anomalous lattice parameter change of the cubic (Hf, Zr) (N, B) solid solution and the highest modulus of rupture of ≈80,000 psi occurs at 40% ZrB_2. These materials were also examined for microstructural features. (auth)

28166 EFFECTS OF GRAIN SIZE AND POROSITY ON ELECTRICAL AND OPTICAL PROPERTIES OF PLZT CERAMICS. Okazaki, K.; Nagata, K. (Defense Academy, Yokosuka, Japan). J. Amer. Ceram. Soc.; 56: No. 2, 82-6(Feb 1973).

A group of transparent ferroelectric hot-pressed $(Pb_{0.92}La_{0.08})$-$(Zr_{0.65}Ti_{0.35})_{0.98}O_3$ specimens with controlled grain size and constant porosity and a group of similar specimens with controlled porosity and constant grain size were prepared. The electrical and optical constants and polarization-reversal properties of these ceramics were determined as functions of grain size and porosity. When poled PLZT ceramics were aged, the polarization-reversal characteristic was asymmetric, apparently because a space-charge field, E_{sp}, was generated during aging. From a detailed study of the behavior of the E_{sp}, including its (1) generation with increasing aging time, (2) relaxation with repeated polarization reversals, (3) relaxation by heat depolarization, and (4) grain-size and porosity dependence, it is concluded that the space-charge layer is present inside every domain. This layer also explains the grain-size dependencies of the remanent polarization, piezoelectric constants, and Curie point. (auth)

28167 FABRICATION OF TRANSPARENT ELECTROOPTIC PLZT CERAMICS BY ATMOSPHERE SINTERING. Snow, G. S. (Sandia Labs., Albuquerque, NM). J. Amer. Ceram. Soc.; 56: No. 2, 91-96(Feb 1973).

PLZT electrooptic ceramics were fabricated by a unique atmosphere sintering technique. The ceramics produced were significantly more transparent than those obtained by ordinary O_2 sintering methods; in fact, they were comparable in transparency to those obtained by hot-pressing. To achieve good transparency, the powder must be batched with excess PbO, which at the sintering temperature is present as a liquid phase at the grain boundaries. Sintering was conducted at 1200°C for 60 h in an atmosphere containing O_2 and a relatively high partial pressure of lead oxide. (auth)

28168 UTILITY LIMIT OF FUEL AND CLADDING MATERIALS. Genshi Doryoku Kenkyukai Teirei Kenkyukai Nenkai Hokokusho; No. 45, vp. (Aug 1971). (In Japanese).

Résumés of three lectures presented in Netherlands–Norwegian Reactor School (1970) are given. Properties of UO_2 pellets affecting fuel performance are described including general characteristics, chemical stability, and effects of non-stoichiometry and burnup on thermal conductivity. Other properties of UO_2 such as melting point, fission gas release, thermal expansion, and swelling by the accumulation of gaseous or solid fission products are also described. Fracture of Zircaloy cladding by hydrogenation and its corrosion by fission products are described along with mechanical interaction between UO_2 fuel pellets and Zircaloy cladding. Mechanisms of cladding deformation are classified. It was found that thermal load, properties of the cladding materials, shape of the pellets, and gap between the pellets and cladding wall affect degree of the deformation. Mechanical properties of Zircaloy are briefly described. Design of fuel rods is discussed. In the last lecture, comparison of pellets and Vipac nuclear fuel is given in the areas of density, burnup, gap between the fuel and cladding, thermal characteristics (such as thermal conductivity, structural change at high temperature), mechanical characteristics (interaction between the fuel and cladding, swelling), chemical characteristics, behavior of defects, and behavior in emergency. (Japan)

28169 SELF-DIFFUSION OF URANIUM IN URANIUM DICARBIDE UC_2. Matzke, H.; Politis, C. (EURATOM, Karlsruhe, Ger.). Solid State Commun.; 12: No. 5, 401-404(1 Mar 1973).

The self-diffusion of uranium in uranium dicarbide, UC_2, was measured between 1670 and 2500°K using the α-energy degradation method with the thin layer condition and ^{233}U as tracer. The activation enthalpy was 5.7 ± 0.2 eV. A discontinuity was indicated at ≈2050°K, the transition temperature of $\alpha-UC_2$ to $\beta-UC_2$. (auth)

28170 CRYSTALLIZATION OF ANODE OXIDE LAYER ON NIOBIUM FOIL. Malyuk, Yu. I.; Chernyakova, L. E. (All-Union Scientific-Research Inst. of Electromechanics, Moscow). Ukr. Khim. Zh.; 39: No. 1, 45-48(Jan 1973). (In Russian).

Anodization of Nb foils under galvanostatic conditions in molten-oxygen-containing salts at 400°C, with a current density of 1 A/cm^2, formed an amorphous film at the Nb surface. The film crystallized to the low-temperature modification Nb_2O_5 with a pseudohexagonal structure. Crystalline nucleating centers appeared on the nonuniform surface of the foil, and crystallization proceeded with the growth of spherulites composed of miniscule acicular crystals. The spherulites were dissected by curved cracks; these microcracks were responsible for increased current leakage and heightened deterioration of the electrical insulating properties of the oxide layer. (tr-auth)

28171 STUDY OF OXIDATION OF METALLIC URANIUM IN AIR BY HIGH-TEMPERATURE METHODS. Bessonov, A. F.; Oleinikov, G. N. Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 104-107(1972). (In Russian).

A method is described for measuring the work function of an electron from a surface directly during sample heating in air from room temperature to 1000°C. This method, used in conjunction with x-ray diffraction, yielded data on the buildup of layers of scale during the process of oxidizing uranium in air at room temperature to 380°C. (KSW)

28172 SYNTHESIS AND CERTAIN PROPERTIES OF RARE EARTH POLYMOLYBDATES OF THE TYPE $Ln_2O_3 \cdot 4MoO_3$. Antonova, S. S.; Shakhno, I. V.; Plyushchev, V. E.; Altukhova, O. A. (Moscow Inst. of Fine Chemical Tech.). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1266-1268(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 8: No. 8, 1438-1440(Aug 1972).

Results of research are presented on synthesis of rare earth and Y tetramolybdates of the type $Ln_2O_3 \cdot 4MoO_3$; results of studies are included on formation conditions and incongruent melting points of these compounds. X-ray phase analysis was used to establish that these are individual compounds and belong to four structural groups: (I) $La_2O_3 \cdot 4MoO_3$; (II) $Ln_2O_3 \cdot 4MoO_3$ (Ln from Pr to Tb); (III) $Ln_2O_3 \cdot 4MoO_3$ (Ln from Dy to Yb and Y); and (IV) $Lu_2O_3 \cdot 4MoO_3$. The pycnometric density of the compound $Ln_2O_3 \cdot 4MoO_3$ was measured. The character of the change of this value confirms the presence of four structural types. (auth)

28173 EFFECT OF THE GASEOUS MEDIUM ON THE PHASE COMPOSITION AND CERTAIN PROPERTIES OF ZIRCONIUM-CONTAINING REFRACTORIES. Strakhov, V. I.; Klyucharov, Ya. V.; Novikov, V. K. (Leningrad Technological Inst.). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1293-1296(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 8: No. 8, 1470-1473(Aug 1972).

Results of reactions between ZrO_2, CeO_2, and Cr_2O_3 were investigated. It was found that roasting of mixtures of ZrO_2, CeO_2, and Cr_2O_3 or compositions of the solid solutions $(ZrO_2-CeO_2)-Cr_2O_3$ in vacuum or a reducing medium leads to intense formation of a cubic solid solution $Ce_2Zr_2O_7-ZrO_2$ and $CeCrO_3$. Cerium (III) chromite is also formed at a high (1750°C) temperature in an oxidizing medium. However, during cooling it decomposes into CeO_2 and Cr_2O_3. Oxidation of $ZrO_2-Ce_2O_3-Cr_2O_3$ specimens is accompanied not only by decomposition of $CeCrO_3$, but also by incorporation of unstabilized ZrO_2 into the tetragonal solid solution ZrO_2-CeO_2. The use of ZrO_2, prestabilized with CeO_2, as the initial material ensures the production of completely sintered zirconium refractories in vacuum and a reducing medium. Additions of Cr_2O_3 greatly increase the strength of artifacts roasted under these conditions. The roasting products of $ZrO_2-Ce_2O_3-Cr_2O_3$ compositions have fairly high thermal stabilities. (auth)

28174 REACTION OF RHENIUM WITH HAFNIUM CARBIDE. Ordan'yan, S. S.; Kosterova, N. V.; Avgustinik, A. I. (Leningrad Technological Inst.). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1317-1318(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 8: No. 8, 1495-1496(Aug 1972).

Results of the investigation show that with increasing rhenium content, the onset temperature of melting of the alloys (determined by the Pirani–Altertum method) decreases from 3900 to 2720°C

for alloys containing 80 wt % rhenium, and then increases in alloys with 95 wt % Re. The character of the change in the melting point and the structure of the alloys indicates that the system HfC–Re is quasibinary and that its phase diagram belongs to the eutectic type, the composition of the eutectic being ~70 at. % Re (~80 wt % Re) and the eutectic temperature 2720 ± 30°C. This served as the basis for constructing a phase diagram of the system HfC–Re. (auth)

28175 PHASE EQUILIBRIA IN THE SYSTEM Gd_2O_3–GeO_2. Petrova, M. A.; Bondar, I. A. (Inst. of Silicate Chemistry, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1319-1321(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 8: No. 8, 1497-1499(Aug 1972).

The phase diagrams were constructed by means of high-temperature microscopy, microstructural analysis of the annealed and quenched specimens, and x-ray phase analysis. The investigation revealed compounds of the following compositions: $2Gd_2O_3$ GeO_2, $Gd_2O_3 \cdot GeO_2$, and $Gd_2O_2 \cdot 2GeO_2$. Physicochemical properties of the compounds are tabulated and diffraction patterns of the individual compounds are shown graphically. (auth)

28176 TETRAGONAL–CUBIC TRANSITION IN THE SYSTEM ZrO_2–Y_2O_3. Nikol'skii, Yu. V.; Filatov, S. K.; Zhuravina, T. A.; Frank-Kamenetskii, V. A. (Leningrad State Univ.). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1322-1324(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 8: No. 8, 1500-1502(Aug 1972).

The smooth tetragonal–cubic transition of materials of the system ZrO_2–Y_2O_3 and the accompanying changes in composition and annealing temperature are described. The specimens were composed of ZrO_2 with Y_2O_3 additions of 3, 5, 7, 15, or 20 mole %. The samples were heated at 800, 1100, or 1400°C for 2 h. As the structure tends to go from the tetragonal to the cubic state, unit cell parameter a decreases while unit cell parameter c increases. These parameters reverse as the structure goes from cubic to tetragonal. This is explained by analysis of the cubic and tetragonal modifications of ZrO2 for comparison. (JRD)

28177 NONUNIFORMITY OF A TANTALUM COATING ON A BIMETALLIC WIRE. Safonova, G. G.; Masterov, V. A.; Kovaleva, N. M. Tsvetn. Metal.; No. 10, 66-69(Oct 1972). (In Russian).

A wire core of Nb was given a Ta coating and subsequently a film of Ta_2O_5 for use in electrolytic condensers. It was desired that the concentration of Nb in the outer surface not exceed 1 to 3%. The technological conditions for maximum uniformity of the coating were optimized by mathematical design of the experiment. (KSW)

28178 CHEMICAL PROPERTIES OF RARE-EARTH-METAL CARBIDES. Kosolapova, T. Ya.; Domasevich, L. T.; Gordienko, S. P.; Makarenko, G. N. (Inst. of Problems of Materials Studies, Kiev). Ukr. Khim. Zh.; 39: No. 1, 9-12(Jan 1973). (In Russian).

The behavior of the carbides of La, Ce, Pr, and Nd in mineral and organic acids, their solutions, water, and organic solvents was investigated. The composition of the gaseous products of reaction of the carbides (H_2, C_2H_2, C_2H_4, C_2H_6, CO_2, NO_2, and SO_2) was determined in each case by chromatography and mass spectrometry. The four carbides mentioned decompose readily in water, bases acids, and are passivated during storage in sealed ampules. (KSW)

28179 CREEP DURING COMPRESSION OF SOLID SOLUTIONS ZrC–NbC IN THE RANGE 2600 to 3150°K. Avgustinik, A. I.; Kats, S. M.; Ordan'yan, S. S.; Gorin, A. I.; Kudryasheva, L. V. (Leningrad Technological Inst.). Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1250-1252(Aug 1972).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.;8 : No. 8, 1417-1420(Aug 1972).

Results are presented of investigations of creep during compression of $Zr_xNb_{1-x}C$ solid solutions obtained by synthesis from the pure elements, in the composition range x = 0.2 to 0.92. In the temperature range 2600 to 3150°K and stress range 1.5 to 5.5 kg/mm², the concentration dependence of the creep rate $\dot{\epsilon}_{30}$ has a deep minimum which levels out with increasing temperature in the virtually equimolar range of compositions. The concentration dependence of the apparent activation energy of creep has a maximum (~190 kcal/mole), which is also located in the equimolar composition range. In the investigated temperature range at stresses 1.5 to 5.5 kg/mm², the creep rate–stress curve is linear, which indicates predominance of the diffusion–viscous creep mechanism. (auth)

28180 IMPROVEMENTS IN PARTICLE CLASSIFYING EQUIPMENT. Hayes, M. R. (to United Kingdom Atomic Energy Authority). British Patent 1,297,788. 29 Nov 1972. Filed date 25 Aug 1969. 5p.

A method is described for grading particles according to their sphericity. Previously used methods are stated to be of limited sensitivity as regards discrimination between spherical and non-spherical particles, and are not always adequate to meet the requirements of industrial processes such as in the manufacture of coated nuclear fuel particles, where it is necessary to remove broken and mis-shapen particles and other debris before and after the application of coating layers. The particles are fed to the upper surface of a horizontal rotatable table, and are accelerated both radially and circumferentially so that most of the surface of each particle comes into contact with the surface of the table, irregularities and defects on a particle surface increasing the drag between particle and table surface and causing the particle to be carried further round the table. Collection means are provided at spaced points around the edge of the table to collect particles of varying grades of sphericity. (UK)

28181 METHOD FOR DEPOSITION OF TUNGSTEN COATINGS. Korolev, Yu. M.; Stolyarov, V. I.; Solov'yev, V. F.; Emel'yanov, A. B.; Mosalkov, A. L. Russian Patent 291,995. 23 Feb 1971. Filed date 9 Sep 1969. (In Russian).

The quality of coatings obtained by hydrogen reduction of WF_6 on a heated substrate is improved by making the process cyclic, with alternate deposition and substrate passivation. Passivation is accomplished by exposure to one of the gas mixture components or to an inert gas at the deposition temperature for 5 to 10 minutes after deposition of an 80 to 120μ thickness. The coatings obtained by this method have a microstructure which improves tensile strength. For example, deposits obtained normally from WF_6 with 6 mol % H_2 at 550°C have tensile strengths of 18 kg/mm² at room temperature and 31 kg/mm² at 1000°C, while deposits obtained by the patent method give corresponding figures of 24 and 47 to 50 kg/mm². (Corros. Abstr.)

28182 X-RAY STUDY OF DEVELOPMENT OF RESIDUAL STRESSES IN HARD METALS. Hoffmann, H.; Boehlke, W.; Hansen, G. Wiss. Z. Tech. Hochsch. Otto von Guericke Magdeburg; 15: No. 5, 491-496(1971). (In German).

For WC and TiC–TaC–WC mixed carbide containing Co, the relationships between residual stress and heat treatment and the modifications to the various phases resulting from the sintering process, were studied. The effects of Co content, polishing, and heat treatment (600 to 800°C in H) are discussed, and previous work is considered. 19 references. (Metals Abstr.)

28183 NUCLEAR FUEL CONTAINING LANTHANIDES. Flipot, A. J.; Gilissen, R. (to Centre d'Etude de l'Energie Nucleaire). Belgian Patent 728,885. 25 Feb 1969.

A procedure is described for the fabrication of nuclear fuels containing a burnable poison consisting of a compound of an element of the lanthanide group characterized by the fact that a small amount of a compound of one of the following elements is added to the constituents of the fuels: titanium, aluminum, magnesium, zirconium, niobium, chromium, vanadium iron, nickel, or copper. (BE)

28184 TECHNIQUES USED AT THE LECI (LABORATOIRE d'ETUDES DES COMBUSTIBLES IRRADIES) TO EXAMINE METALLICALLY CLAD FUEL ELEMENTS. Bazin, J.; Vignesault, N.; Hamonniere, C.; Perrot, M. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 174, 19-27(Oct 1972). (In French).

The behavior of fission products produced during the irradiation of ceramic fuel elements are studied at the LECI (Laboratoire d'Etudes des Combustibles Irradies). Various techniques are used to determine the distribution of these elements (which may be in volatile, soluble, or insoluble forms) in the ceramic matrix. The following techniques are described: γ spectrometry; fission gas sampling; metallography; x-ray microanalysis. Applications are cited. (FR)

28185 HOMOGENEOUS NEUTRONIC EXPANDED GRAPHITE/URANIUM CARBIDE MOCKUP. Slonina, J. P. (Societe le Carbone, Lorraine, Paris); Maire, J.; Nouguier, H.; Bouchard, J. pp 179-182 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In French).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

A carbon–uranium neutronic mock-up was obtained by agglomeration of molten uranium carbide balls with expanded graphite. This agglomeration is effected at room temperature and the working method allows one to obtain a perfect close-packed (cubic body-centered) arrangement of the uranium carbide in the graphite matrix. A large freedom exists for the choice of the C/U ratio and of the density of the carbon matrix. (auth)

28186 INFLUENCE ON THE MECHANICAL STRENGTH OF SPHERICAL FUEL ELEMENTS BY CONDITIONS PRESENT DURING REACTOR OPERATION. Kleine-Tebbe, A.; Ragoss, H. (Hochtemperatur-Reaktorbau GmbH, Juelich, Ger.). pp 197-199 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Experimental tests on the influence of temperature, corrosion (by water), initial loading, and neutron irradiation on the mechanical strength of spherical fuel elements are reported. In general, due to temperature and radiation hardening, an increase in fracture toughness has to be assumed. Even if additional stress from temperature changes and Wigner effect is taken into account, and even for pessimistic assumptions during reactor operation, no decrease in mechanical strength, as specified by the manufacturer, is to be expected. (auth)

28187 FABRICATION AND IRRADIATION BEHAVIOR OF ADVANCED FUELS FOR THE HTGR. Scott, J. L.; Pollock, C. B.; Hamner, R. L.; Robbins, J. M.; Coobs, J. H.; Eatherly, W. P. (Oak Ridge National Lab., TN). pp 200-201 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The HTGR reference fuel, which consists of UC_2 and ThC_2 microspheres coated with pyrolytic carbon and SiC and bonded into fuel sticks with a carbonaceous binder, has been demonstrated to full HTGR burnup and fast-neutron exposure in several irradiation experiments. Consequently, emphasis at ORNL has shifted to the preparation and testing of advanced fuels containing sol-gel oxides [UO_2, ThO_2, and $(Th,U)O_2$] which are more consistent with the remote fuel refabrication. A recent development, the resin-derived fissile particle, is also being tested extensively. Fuel sticks containing these fuels have been fabricated by alternate techniques such as extrusion and warm molding as well as intrusion bonding. Irradiation tests performed to date indicate that coated oxides and fueled resin particles perform well and that a variety of graphitic or carbonaceous filler materials may be used to fabricate intrusion-bonded sticks. (auth)

28188 RESIN RHEOLOGY IN THE PRESSING OF GRAPHITE NUCLEAR FUEL BODIES. Voice, E. H. (Organization for Economic Co-Operation and Development, Dorchester, Eng.); Orrell, E. W. p.202 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

To avoid damage to the coated nuclear fuel particles at high volume loading in compacted bodies, both the pressing pressure and "overcoating" distortion should be kept low, while yet attaining the highest possible fired density and strength. The investigation of a carbonizable phenol formaldehyde resin binder for this purpose is described, in the course of which some misconceptions concerning the molecular weight and viscosity of polymers were exposed. Some considerations in the selection of the graphite filler powder are also discussed. (auth)

28189 IRRADIATION BEHAVIOR OF PRESSED MATRIX MATERIAL. Nickel, H.; Haag, G.; Schulze, R. E. (Kernforschungsanlage, Juelich, Ger.). pp 208-211 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The linear dimensional changes of the so-called "A3" standard matrix developed specifically for HTR fuel elements were studied in relation to fluence and temperature during neutron irradiation. The fluence of increasing binder or natural graphite component on the dimensional changes is demonstrated as well as the effect of not well graphitized petrol coke. Unexpected changes of thermal conductivity as a function of fluence and irradiation temperature are discussed in detail with a specific matrix material. (auth)

28190 PRODUCTION OF BONDING-MATRIX MATERIALS AND THEIR BEHAVIOR DURING IRRADIATION. Luhleich, H.; Dias, F.; Haag, G.; Nickel, H.; Pflaum, P. (Kernforschungsanlage, Juelich, Ger.). pp 212-215 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The report deals with the production of matrix materials provided for the embedding of coated nuclear fuel particles in fuel elements of high-temperature reactors. Investigations were carried out as to the influences of the binder content and of the mixing and grinding process on the properties of the matrix elements. As the matrix samples being manufactured in accordance with conventional methods are very inhomogeneous, particularly in the case of increased binder contents (up to 50% in weight), a new chemical wet mixing procedure was developed with subsequent production of test specimens being exposed to radiation. A good homogeneity of the material could be proved by the irradiation behavior of these samples. Contrary to previous irradiation tests, there was only a slight shrinkage of these matrix samples, which was further decreased with increasing binder content. (auth)

Metals and Alloys

Corrosion and Erosion

Refer also to abstract 28117.

28191 (BNWL-7) FRETTING CORROSION OF N-REACTOR FUEL ASSEMBLIES AND PROCESS TUBE IN OUT-OF-REACTOR TESTING. Larrick, A. P.; Robinson, R. K. (Battelle Pacific Northwest Labs., Richland, Wash.). Jan 1965. Contract AT(45-1)-1830. 38p. Dep. NTIS $4.00.

Declassified 2 Apr 1973.

Fretting corrosion resistance of N-Reactor Zircaloy-2 clad fuel elements in hot flowing water was studied in an out-of-reactor loop. Accelerated fretting corrosion of the inside of the outer fuel tube by the contacting supports of the inner fuel tube was observed in several fuel element assemblies. Fretting corrosion of the Zircaloy-2 process tube by the contacting supports of the outer fuel tube was also observed. (auth)

28192 (BNWL-85) ZIRCALOY-2 CREVICE CORROSION. Winegardner, W. K. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jul 1965. Contract AT(45-1)-1830. 44p. Dep. NTIS $4.25.

Declassified 3 Apr 1973.

Out-of-reactor tests were conducted to study corrosion of Zircaloy-2 in heated and unheated crevices with geometries similar to those existing on heat-transfer surfaces of reactor fuel elements. Test assemblies were electrically heated and exposed in high-temperature (288 to 315°C), recirculating water loops. The pH of the high-purity loop water was adjusted to about 10; tests were conducted in both lithiated and ammoniated water. Heat flux associated with heated crevices ranged from 400 to 1100 W/in.^{2} Extensive crevice corrosion was found only in tests using lithiated water. It is felt that the crevice attack was the result of the concentration of lithium hydroxide by local boiling. Test results indicate that Zircaloy fuel element surface crevices of a geometry that will allow the concentration of chemical additives by local boiling should be avoided if lithiated coolant is used. (auth)

28193 COMPATIBILITY OF REACTOR MATERIALS WITH HIGH-TEMPERATURE GASES. Titus, G. W.; Clarke, W. L. Jr. (General Electric Co., San Jose, CA). Nucl. Eng. Des.; 24: No. 1, 125-144(Jan 1973).

The literature pertaining to the compatibility of reactor materials at high temperatures with the common atmospheric gases and hydrogen is surveyed. More detailed data are available from the literature cited. (auth)

28194 CATALYTIC METAL COATING OR DEPOSIT ON PIECES MADE OF Zr OR Zr ALLOY, PART OF WHICH IS SUBJECTED TO A CORROSIVE MEDIUM. Visani, T. (to EURATOM). Belgian Patent 722,254. 11 Oct 1968. Priority date 7 Nov 1967, United Kingdom of Great Britain and Northern Ireland (UK).

At least a part of the surface that is not in contact with the corrosive medium is covered with metal catalyst for the reaction of hydrogen with an oxidant such as oxygen or carbon monoxide present on the surface. The catalytic metal is an element of Group VIII of the periodic table or an alloy or mixture of these elements applied in the form of a thin coating, of wire, or of pieces soldered on the surface of the piece. (BE)

28195 PHOTOEMISSION SPECTRA FROM ADSORBED O ON W(110) AND CO ON W(100). Baker, J. M.; Eastman, D. E. (IBM Watson Research Center, Yorktown Heights, NY). J. Vac. Sci. Technol.; 10: No. 1, 223-226(1973).

Photoemission energy distribution curves are presented for adsorbed layers of O on W(110) and CO on W(100) surfaces. The electronic energy levels of adsorbed oxygen initially form a 2.0 eV-wide peak at −6.4 eV below the Fermi level which shifts to −6.0 eV and broadens to 2.8 eV with increasing coverage. Provision for simultaneous LEED, Auger spectroscopy, and flash desorption enable the structure and coverage of the adsorbed layers to be determined. β-phase CO adsorbed in either the (1×1) or $C(2 \times 2)$ structures on W(100) produces a photoemission peak at −6.0 eV with a weaker peak at −3.5 eV. Adsorption of CO in the α phase gives rise to a 2.2 eV-wide peak at −8.9 eV which is identified as originating from levels essentially the same as those of molecular CO. (auth)

28196 QUANTITATIVE AES AND LEED STUDY OF ALKALI METAL OVERLAYERS ON W(100). Thomas, S.; Haas, T. W.

(Aerospace Research Labs., Wright-Patterson AFB, OH). J. Vac. Sci. Technol.; 10: No. 1, 218-222(1973).

Experimental Auger calibration curves were obtained for Cs, Rb, K, and Na adsorbed on a W(100) substrate, by monitoring the ratio of the adsorbate–substrate Auger peak-to-peak heights with coverage. A comparative study is made on such curves obtained in the four-grid LEED system and the cylindrical mirror analyzer. The adsorbate on a W substrate has an enhanced Auger yield over that on a Mo substrate due to the increase in the backscattering factor. The attenuation of the substrate Auger electrons is dependent on the atomic number of the alkali adsorbates. The first well-defined LEED pattern during the alkali adsorption revealed a C(2 × 2) structure. At higher coverages a two-domain hcp structure was observed with no change in the C(2 × 2) structure. (auth)

28197 TIME-OF-FLIGHT ANALYSIS OF IONS AND EXCITED NEUTRALS RELEASED BY ESD OF CO ON (100) W. Newsham, I. G.; Sandstrom, D. R. (Washington State Univ., Pullman). J. Vac. Sci. Technol.; 10: No. 1, 39-42(1973).

The release of ions and excited neutrals by the interaction of low-energy electrons with CO on (100) W is studied by a time-of-flight technique. The flight time distributions, approximate threshold energies, adsorption kinetics, and dependence behavior of the desorbed particle currents upon heating and heavy electron bombardment are presented for the excited neutrals, CO^+, and O^+ ions in the temperature range 110 to 600°K. The fact that the binding state producing the excited neutrals is identical with the state releasing CO^+ ions suggests that the excited neutrals are CO molecules. (auth)

28198 IN SITU SPUTTER CLEANING OF THIN-FILM METAL SUBSTRATES FOR UHV–TEM CORROSION STUDIES. Heinemann, K.; Poppa, H. (Ames Research Center, Moffett Field, CA). J. Vac. Sci. Technol.; 10: No. 1, 22-25(1973).

A prerequisite for conducting valid corrosion experiments by in situ electron microscopy techniques is not only the achievement of uhv background pressure conditions at the site of the specimen but also the ability to clean the surface of the thin metal substrate specimen before initiation of the corrosive interaction. A miniaturized simple ion gun was constructed for this purpose. The gun is small enough to be incorporated into an uhv electron microscope specimen chamber with hot stage in such a way as to permit bombardment of the substrate specimen while observing it by transmission electron microscopy. It is shown that the ion beam generated is confined well enough to cause a sputtering removal of substrate material at a rate of approximately 5–10 Å/min and to prevent the sputter deposition of contaminating material from the specimen holder. Thin single-crystal Ni (100) film samples were used to demonstrate the applicability of the sputter cleaning technique, to show the removal of ion beam induced radiation damage by annealing, and to evaluate preliminary oxidation tests by selected zone dark-field microscopy. (auth)

28199 NIOBIUM–TANTALUM–TITANIUM ALLOY FOR USE IN HIGHLY CORROSIVE CHEMICAL ENVIRONMENTS. Georgieva, I. Ya.; Gulyaev, A. P. Tr. Mosk. Inst. Khim. Mashinostr.; No. 38, 46-49(1971). (In Russian).

The corrosion resistance of a Nb–Ti–Ta alloy in highly aggressive chemical environments was studied, with the object of using this alloy for the replacement of Ta. (Referativnyi Zh.)

28200 AQUEOUS CORROSION IN NUCLEAR INSTALLATIONS. Continued and Concluded. Coriou, H. (CEN, Fontenay-aux-Roses France). Ind. At. Spatiales; 16: No. 3, 11-22(May 1972). (In French).

The corrosion behavior in nitric medium austenitic stainless steels used in plants for reprocessing fuel from a natural U–graphite–CO_2 reactor was investigated. The principles of the Purex process used are given. The various aspects of corrosion encountered in these materials were examined: general and intergranular corrosion in nitrofluorhydric media, effect of Mo. The behavior of the materials as a function of the conditions to which they are subjected during operation is investigated: corrosion in the transpassivity and cathodic regions. (France)

28201 X-RAY-MICROPROBE ANALYSIS FOR STUDYING OXIDATION OF NIOBIUM- AND TUNGSTEN-BASED ALLOYS. Maslenkov, S. B.; Lazareva, I. Yu.; Ugaste, Yu. E. Sb. Tr. Tsent. Nauch. Issled. Inst. Chern. Met.; No. 79, 203-208(1972). (In Russian).

Data on the oxides, suboxide layers, and internal oxidation zones in Nb and W alloys (containing V + Ti and Ti + Nb respectively) that had been oxidized in the range 900 to 1300°C, were obtained by x-ray-microprobe analysis. Selectiveness in the oxidation process was demonstrated and the two-way nature of the reaction diffusion established. (Metals Abstr.)

28202 METHOD FOR DEPOSITION OF TUNGSTEN COATINGS. Chuzhko, R. K.; Kirillov, I. V.; Golovanov, Yu. N.; (and others). Russian Patent 289,147. 26 Jan 1971. Filed date 21 Jun 1968. (In Russian).

Monocrystalline W coatings are deposited on monocrystalline substrates by hydrogen reduction of WF_6. Oxides are first removed from the substrates by heating in currents of hydrogen at 800 to 1200°C. Coating is carried out with a H_2:WF_6 ratio of 3 to 6 and a WF_6 pressure of 0.001 to 0.003 at. at 800 to 1200°C and a flow rate from 15 to 100 m/sec. Reaction chamber dwell time is 0.1 to 1 sec. Monocrystalline W and Mo may be used as the substrate. (Corros. Abstr.)

28203 MOLYBDENUM IN THE PROTECTION OF METALS AND ITS PROTECTION. Galvano; 41: No. 420, 231-233(Mar 1972). (In French).

Molybdenum is used in the protection of metals as a corrosion inhibitor (molybdate), as an oxide coating, in combination with NiO produced by electrolysis, as an accelerator in phosphating baths, in vitreous enamels, and in alloy co-deposits with Ni, Co, Fe, and Co–W. Methods of protecting Mo against atmospheric attack by Cr plating are described. (Metals Abstr.)

28204 COMPOUND RAW MATERIAL MADE OF V ALLOYS TO BE USED AS BUILDING MATERIAL OR AS NUCLEAR REACTOR CAN. Borgstedt, H. U.; Wincierz, P.; Ruhle, M. (to Gesellschaft fuer Kernforschung mbH). Priority date 14 Mar 1968, Federal Republic of Germany (F. R. Germany).

A compound material is described that is especially resistant to corrosion when used as a constuction material and as a can for nuclear fuel elements. It has good mechanical resistance, is resistant to corrosion by reactor coolants, and is characterized by having a vanadium base. (BE)

28205 REACTION OF RHENIUM WITH CARBON. Savitskii, E. M.; Tylkina, M. A.; Konieva, L. Z.; Kashin, V. I.; Klibanov, E. L. Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 134-137 (1972). (In Russian).

Rhenium metal was melted in a graphite crucible which served both as the anode of an electric furnace and as the source of carbon atoms in a diffusion study that assured complete saturation of C in Re (4.39% wt % C). The phase composition of the alloys was investigated by microhardness, microstructural and x-ray analyses. A metastable carbide, Re_xC (where x was about 2 to 4), was observed as one of the products of the reaction. (KSW)

28206 CORROSION OF NICKEL–MOLYBDENUM ALLOY TYPE EP 496 IN HYDROCHLORIC ACID SOLUTIONS CONTAINING FLUORIDE ION. Matusevich, V. S.; Lebedev, A. N.; Fokin, M. N.; Konstantinova, E. V. Zashch. Metal.; 8: No. 3, 317-320 (1972). (In Russian).

Corrosion and electrochemical tests, using vessels lined with fluoroplast-4, were made to study the behavior of the Ni–Mo alloy EP 496 (C < 0.05, Si < 0.5, Mn < 0.5, V 1.4-1.7, Fe < 4.0, and Mo 25 to 29%, balance Ni) in the HCl + HF + H_2O system at 104°C. Specimens were cut from sheet material and heat treated by quenching from 1050°C. The alloy has good corrosion resistance, e.g. in 10 M-HCl containing up to 1.0 M-F^-, but the presence of oxidizing agents, e.g. Fe^{3+} (as may arise during industrial processes) causes transpassivity and an increased corrosion rate. Tests were therefore made to find suitable reducing agents to prevent this. Of those examined, $SnCl_2$ and metallic Ti were the most effective in reducing the corrosion rates in boiling 10 M-HCl + 0.2 M-F^- + 5 g/l. Fe^{3+} in 5 h tests from 22.4 to 0.5 and to 0.52 g/m^{2}h, respectively. (Metals Abstr.)

Preparation and Fabrication

Refer also to abstracts 28147, 28177, 28276, and 28323.

28207 (AERE-R-2544) TECHNIQUE FOR WELDING SMALL REFRACTORY METAL CAPSULES. Moreton-Smith, M. J.; Taylor, R. G. (Atomic Energy Research Establishment, Harwell (England)). Nov 1972. 9p. Dep. NTIS (U. S. Sales Only). UK 50 pence.

A technique is described for welding refractory metal capsules under a controlled atmosphere. High-integrity welds have been obtained with capsules of TZM and TZC molybdenum alloys. The technique has been shown also to be suitable for stainless steel. (auth)

28208 (CEA-CONF-2170) PREPARATION OF PURE MATERIALS. Thermodynamic Principles. Schaub, B. (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 12 Apr 1972. 12p. (In French). (CONF-721141-1). Dep. NTIS (U. S. Sales Only).

Principles of some of the usual methods of purification are discussed, namely: (1) significance of the partition coefficient be-

tween the solid and liquid phase of an element in dilute solution; role of the rate of solidification on the effective partition coefficient; (2) thermodynamic activity—evaporation rate and purification by selective vaporization; and (3) criteria for selection of a purification method (selection of crucibles, residual atmospheres, etc.). In (3), some discussion is devoted to the free energy of formation of oxides. (tr-auth)

28209 (TID-26292) AEC-APPROVED ANSI B31 CODE CASES. (Directorate of Licensing (AEC), Washington, D. C.). Mar 1973. 10p. Dep. NTIS $3.00.

A list of piping and pressure vessel code cases which the Directorate of Licensing found to be acceptable or unacceptable for use by AEC licensees is presented. (JRD)

28210 FABRICATION OF FRAMED BERYLLIUM WINDOWS BY HIGH-RATE PHYSICAL VAPOR DEPOSITION PROCESSES. Bunshah, R. F. (Univ. of California, Los Angeles); Juntz, R. S. J. Vac. Sci. Technol.; 10: No. 1, 83-84(1973).

Beryllium windows are used in radiation generators and detectors such as x-ray tubes, counters, etc., because of the low atomic number of beryllium. In current practice, thin foils of beryllium >0.001-in. thickness are brazed or welded into a frame which is then attached to the apparatus. This presents the problems of procurement of the thin foil and damage to it during the joining process. In our technique, beryllium is evaporated onto a substrate such as copper to the desired thickness and the window is produced by dissolving the substrate with concentrated nitric acid in the window area after masking off the area which forms the frame. Thus, a framed window of different shapes can be produced. The principal problem is porosity in the deposit below 0.002-in. thickness. (auth)

28211 KINETICS OF THE CHEMICAL VAPOR DEPOSITION OF TUNGSTEN. Bryant, W. A. (Westinghouse Astronuclear Lab., Pittsburgh); Meier, G. H. J. Electrochem. Soc.; 120: No. 4, 559-565(Apr 1973).

The kinetics of the chemical vapor deposition of tungsten by the hydrogen reduction of WF_6 were studied over the system pressure range from 6 to 60 torr and over the temperature range from 500 to 870°C to determine the operative rate controlling mechanisms. Within the pressure and temperature ranges studied HF desorption from the substrate was determined to be rate limiting for lower pressure-temperature combinations. An activation energy of 7300 cal/mole was associated with this mechanism. At higher pressure-temperature combinations WF_6 diffusion to the substrate was rate controlling. The activation energy for this process was found to be 1650 cal/mole. (auth)

28212 EFFECTS OF DEPOSITION TEMPERATURES ON Ta THIN FILM RESISTORS REACTIVELY SPUTTERED IN OXYGEN. Hardy, W. R.; Mills, D. (Microsystems International Ltd., Ottawa). J. Vac. Sci. Technol.; 10: No. 1, 303-306(1973).

Effects of substrate temperature on the resistivity and temperature coefficient (TCR) of Ta thin film resistors were studied by depositing films onto glass substrates for which the temperature at the start of sputtering was varied from 25 to 285°C. For these films which were reactively sputtered in oxygen flowing at a constant rate, the film resistivity decreases, the film TCR increases in the positive direction, and the average oxygen concentration in the films decreases as the initial substrate temperature is increased. The fact that the dependence of the resistivity and TCR of these films on the average oxygen concentration is the same as for films in which the oxygen concentration is varied by depositing the films at a single substrate temperature and varying the oxygen flow rate into the system indicates that the main effect of substrate temperature during deposition is to change the oxygen concentration in the films, rather than directly introducing any temperature-dependent changes in the film properties. For films containing from 10 to 20 at. % oxygen, the Ta condensation coefficient and film growth rate are largely independent of temperature. (auth)

28213 REDUCING THE BRITTLENESS OF Be. Armbruster, M.; Kamoun, G.; Sertour, G. Entropie; No. 47, 19-34(Sep 1972). (In French).

Research work was undertaken to establish a means of preparing items made of Be having optimized mechanical and fatigue-resistance properties. Three types of machining (mechanical, electroerosion, and electrochemical) and three types of finishing (electrolytic polishing, chemical polishing, and glass-shot granulation) methods were investigated. The best results were obtained using electrochemical machining and electrochemical polishing. (France)

28214 MACHINING TECHNIQUES IN THE LABORATORY EXAMINING ACTIVE FUELS. Huillery, R. (CEN de Cadarache, Saint-Paul-les-Durance, France). Bull. Inform. Sci. Tech. (Paris); No. 172, 55-62(Nov 1972). (In French).

The wide range of materials examined necessitates the use of various machining methods. The usual means of sectioning, milling, and turning are supplemented by the conventional methods such as electro-erosion and ultrasonics. This machining equipment was designed to be compact, versatile, easy to maintain, and economical. (France)

28215 TECHNOLOGICAL PROCEDURE FOR THE ELECTRIC-SPARK MELTING OF ALLOY COMPONENTS. Samsonov, G. V.; Vierchoturov, A. D.; Timofeev, I. I.; Rudi, A. N. Elektronika; No. 12, 509-516(1972). (In Polish).

The technological process for electric-sparking production and melting of alloy components of transition metals from groups IV, V, and VI is described. (auth)

28216 X-RAY-DIFFRACTION STUDY OF THE EFFECT OF SOME PARAMETERS OF ELECTROANALYSIS ON THE COMPOSITION OF NICKEL ALLOYS WITH TUNGSTEN. Bondarenko, V. P.; Ryabukhin, A. G. Tr. Kurgan. Mashinostroit. Inst.; No. 17, 37-41(1971). (In Russian).

Alloys of Ni-W were obtained from ammonia and ammonium citrate solutions for various currents. An x-ray-diffraction study was made of the effect of the solution temperature and the coating composition on the intensity of 111 Ni line. The maximum intensity corresponded to a temperature of 60°C. With a W content of 44%, the line corresponding to reflection from the Ni_4W lattice appeared on the diffraction curves. (JPRS)

28217 PRODUCTION OF CONTINUOUS COATINGS OF VANADIUM BY ELECTROLYSIS OF HALIDE MELTS. Ivanovskii, L. E.; Kotelevskaya, V. A.; Raskin, B. Ya. Tr. Inst. Elektrokhin., Ural. Nauch. Tsentr Akad. Nauk; No. 17, 124-126(1971). (In Russian).

The precipitation of V during electrolysis of chloride and bromide–chloride melts is studied. It is shown that continuous cathode sediments several millimeters thick can be produced with D_c = 10 to 20 mA/cm² at 400 to 450°. Increasing the temperature in D_c causes formation of a dendritic sediment. (JPRS)

28218 METHOD OF ANODIZATION OF BERYLLIUM AND ITS ALLOYS. Vol'fson, A. I.; Umov, V. S.; Polonskii, E. L.; Markova, N. E.; Chernyshov, V. V.; Lebedev, V. N. Russian Patent 305,210. 13 Jul 1971. Filed date 5 Feb 1970. (In Russian).

A method of anodization of beryllium and its alloys in an electrolyte containing H_3BO_3, differing in that in order to increase the corrosion resistance of the film, ethylene glycol and ammonia are introduced to the electrolyte in the following relationship (g/l): ethylene glycol 50 to 150, H_3BO_3 30 to 160, 25% ammonia solution, ml 40 to 100, and the process is conducted at 10 to 40°C, D_c 0.2 to 2 a/dm². (JPRS)

28219 ELECTRODEPOSITION OF CADMIUM FROM A TRILON [EDTA] ELECTROLYTE. Napukh, E. Z.; Lozhkina, T. V. Zashch. Metal.; 8: No. 2, 216-218(1972). (In Russian).

Studies were made of the effects of Trilon B concentration and pH on the structure of deposited Cd coatings and on the polarization and throwing power. All plating solutions contained 0.5 N Cd. Consideration is given to the mechanism of the deposition in terms of the nature of the complexes present. With [V] = the anion of ethylenediaminetetra-acetic acid, a change in the nature of the discharging complex in alkaline electrolytes from $[CdV(OH)]^{3-}$ to $[CdV]^{2-}$ on increasing the Trilon B concentration of 180 g/l or higher, leads to an alteration in the deposition potential and to an improvement in the structure and uniformity (with respect to distribution) of the Cd deposits. Acid electrolytes containing dextrin and $(NH_4)_2SO_4$ yield semi-bright deposits, but with some reduction in uniformity and ~50% reduction in the rate of the process. (Metals Abstr.)

28220 APPLICATION OF ELECTRICALLY GENERATED GAS PLASMA IN PROCESS METALLURGY. I. General Applications of Gas Plasmas and Measuring Heat Flow Produced by Plasma Burners of Different Design. Chandra, U.; Hartwig, J.; Ulrich, K. H. Tech. Mitt. Krupp, Forschungsber.; 29: No. 3-4, 143-150(Dec 1971). (In German).

Gas plasma arcs can be used in chemical and metallurgical processes including the smelting of non-ferrous metals, the cutting of metals and alloys such as Ti, Al, Cu alloys, and alloy steels; the welding of Cu, Cu alloys, and alloy steels; and in the spraying of materials such as Al_2O_3, ZrO_2, WC, Mo, TiO_2, and Cr_2O_3. The results are given of smelting trials in which the gas plasma melting of Ti, Zr, and Ta powder was undertaken to determine the most suitable design of plasma burner. The most efficient type of plasma burner was one in which the bath acts as the arc anode. (22 references). (Metals Abstr.)

28221 EFFECT OF LIQUID-METAL OXIDATION ON THE CONCENTRATION OF NONMETALLIC INCLUSIONS IN CASTINGS. Vashchenko, K. I.; Larin, V. K. Liteinoe Proizvod.; No. 3, 23-25(Mar 1972). (In Russian).

The temperature of dross formation was studied by radiation pyrometry for binary alloys of Fe with Cr, Ti, Si, Mn, and V. There appeared to be two temperatures corresponding to Fe oxide formation and alloying metal oxide formation. Three alloys, characterized by different dross formation temperatures and more particularly, by differences between melting point and dross formation temperature, were melted. The bulk concentrations of metal oxides in the sample were measured by chemical analysis, and the surface investigated by x-ray analysis. Reducing the dross formation temperature gives less oxide inclusions in the final product. (Metals Abstr.)

28222 KINETICS OF REMOVAL OF INTERSTITIAL IMPURITIES IN SWEATING OF METALLOCERAMIC TUNGSTEN WITH AN ELECTRON BEAM. Zhudinov, M. I. Elektron. Obrab. Mater.; No. 3, 19-21(1972). (In Russian).

A new method for making W parts based on the sweating of an earlier-assembled framework by means of an electron beam is described. This method has the additional advantage that it tends to eliminate interstitial impurities of the kind normally removed from W by electron-beam zone melting. The efficiency of this refining depends on the electrical parameters of the process and the velocity of the parts subject to treatment. Optimizing criteria are presented. (Metals Abstr.)

28223 CONDITIONS FOR ELECTRODEPOSITION OF A CADMIUM–TIN ALLOY FROM A CHLORIDE–FLUORIDE ELECTROLYTE. Tyutina, K. M.; Kubasova, E. N.; Kudryavtsev, N. T. Zashch. Metal.; 8: No. 3, 358-361(1972). (In Russian).

The experimental development of a $Cl^- - F^-$ electrolyte for deposition of Cd–Sn alloys is described. Fine-grained, bright, dense, resilient Cd–Sn alloy coatings containing 20 to 30% Sn were produced from an electrolyte containing 0.3 N $SnCl_2$, 0.5 N $CdCl_2$, 1.2 N NH_4F, and 2 ml/l of a polyethoxyamine, temperature 18 to 20°C, cathodic current density 0.75 to 1.5 A/dm². The anode should be of similar composition to that of the deposited alloy with anodic current density of 0.5 to 6.0 A/dm². Current efficiency is 98 to 100%. (Metals Abstr.)

28224 CHOICE OF A FILLER MATERIAL FOR WELDING ALLOYS OF THE Mg–Zn–Zr–RARE-EARTH METAL SYSTEM. Ryazantsev, V. I. Svar. Proizv.; No. 7, 9-11(Jul 1972). (In Russian).

Magnesium alloys containing Ce 0.1 to 0.5% were arc-welded with various fillers containing Zn 1 to 3% and up to 4.2 Ce, 7 Zr, and 9% Al. Temperature range of crystallization and the tendency towards cracking in the joint metals are tabulated, and microstructural phenomena discussed. The mechanical properties of the joint metals are also tabulated. Fillers are recommended, based on Mg, with Zn 1.2, Zr 0.6, Ce 3.2 or Zn 1.2, Al 6, and Mn 0.5%. (Metals Abstr.)

28225 WELDING BERYLLIUM WITH TITANIUM AND STEEL. Ignatovskaya, G. S.; Komarov, M. A. Svar. Proizv.; No. 1, 17-18 (Jan 1973). (In Russian).

The possibility of welding beryllium with OT4 titanium alloy and 1Kh18N10T stainless steel was investigated. Rods of distilled beryllium (coarseness of initial powder was 355 microns) were used. The effect of the intermediate strip material was studied along with welding temperature and time and their effect on weld joint strength. Tests on the direct welding of beryllium to steel and titanium did not give good results. Therefore a material was selected which has a region of solid solutions with beryllium at high temperatures. The best material was found to be silver in comparison with nickel and copper. Using a silver intermediate strip, welds with 1Kh18N10T and 0T4 were vacuum tight and had a strength of more than 30 kgf/mm². A welding temperature of 750°C was the best temperature to yield the highest strengths: 35.0 to 39.1 kgf/mm² and 37.2 to 42.2 kgf/mm² for 1Kh18N10T and 0T4, respectively. Cryogenic tests showed that weld joint strength at –196 and –70°C was almost the same as at room temperature. The maximum operating temperature for Be + 1Kh18N10T and Be + 0T4 welds was found to be 300°C. (JPRS)

28226 UTILIZATION OF EXPLOSIVE ENERGY IN METAL-WORKING. Koegel, H.; Meyer, G. Technik (Berlin); 27: No. 2, 111-115(Feb 1972). (In German).

The history of explosive working metals, the applications of explosive welding, its limitations, and the characteristics of explosion welds are described. Micrographs of sections from joints in various materials are shown. Economy in material is discussed with special reference to cladding of steel with Ti, Ta, or Zr. Explosive hardening especially that in 12%Mn steel and explosive forming of sheet with production of hemispheres in 18:8 Cr–Ni steel are outlined. (26 references). (Metals Abstr.)

Properties, Structure, and Phase Studies

Refer also to abstracts 27527, 28118, 28130, 28132, 28134, 28143, 28144, 28170, 28277, 28366, and 29313.

28227 (LA-UR-73-188) SURFACE AREAS OF URANIUM AND URANIUM HYDRIDE POWDERS. Alire, R. M. (Los Alamos Scientific Lab., N. Mex.). [nd]. 12p. Dep. NTIS $3.00.

The BET surface area measurements have provided a frame of reference to study the effects of differences in surfaces on the reaction rates of uranium and uranium hydride with gases. It is not believed that these measurements represent absolute values of the specific surface area, but are a relative comparison of the different surfaces. Good correlation between rate constants and the BET surface area was demonstrated. It is felt that any measurements made on powders of uranium or uranium hydride should include a BET surface area measurement of the starting material. Attempts to draw conclusions about the particle size or shape of powders from BET surface areas are generally not informative. (auth)

28228 APPLICATIONS AND RECENT DEVELOPMENTS IN TRANSMISSION ELECTRON MICROSCOPY. Bell, W. L.; Thomas, G. (Univ. of California, Berkeley). pp 23-59 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Recent applications of conventional electron microscopy are described with examples of microscopic study results on ordering and spinodal phase transformations and microstructure-property relationships in structural steels. New trends in microscopy which have come about due to the development of high-voltage instruments are also reviewed. These developments include improvements in resolution and applications outside the traditional metallographic areas, e.g., ceramics, semiconductors, and mineralogy. Examples of such developments are presented. (auth)

28229 FUNDAMENTAL ASPECTS AND APPLICATIONS OF HIGH-VOLTAGE ELECTRON METALLOGRAPHY. Fisher, R. M. (U. S. Steel Corp. Research Center, Monroeville, PA). pp 60-84 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Studies of electron-diffraction effects characteristic of high-voltage electron microscopy (HVEM) due to enhanced many-beam interactions that give rise to Bloch wave channeling, a critical voltage phenomenon, and changes in the nature of Kikuchi patterns are summarized. These effects permit examination of thick specimens and the use of stereo techniques as well as local measurements of Debye temperatures, long-range order, or alloy segregation. Applications to many areas of metallurgical research including plastic deformation, corrosion, precipitation, and hydrogen cracking are also described. (auth)

28230 SCANNING ELECTRON MICROSCOPY STUDY OF AN ION-ETCHED URANIUM ALLOY. Thomas, G. J.; Miglionico, C. J. (Sandia Labs., Albuquerque, NM). pp 339-346 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Using an ion etching technique and scanning electron microscopy, a metallographic study of a uranium alloy was performed. Inclusions exposed in relief by the etching were studied by energy-dispersive x-ray analysis. In addition to investigating the nature of the inclusions, samples were examined for microstructural changes within grains after various aging treatments, and after mechanical deformation. (auth)

28231 NATURE AND STABILITY OF DISLOCATION DISTRIBUTIONS IN BCC METALS. Boyd, J. D.; Embury, J. D. (Battelle Columbus Labs., OH). pp 470-483 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of elec-

tron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Relations of the stability of the accumulated dislocation distribution in bcc metals with factors controlling flow stress are examined. Discussions are included on dislocation distributions in niobium single crystals deformed in compression at a variety of strain rates, and the stability of these distributions with respect to thermal recovery. A broad rationalization of these results is presented in regard to the thermal and mechanical stability of dislocation substructures in bcc metals with particular reference to decarburized iron. (JRD)

28232 SYNERGY OF TRANSMISSION ELECTRON MICROSCOPY, SELECTED AREA X-RAY TOPOGRAPHY, AND X-RAY LINE PROFILE ANALYSIS IN DEFORMATION STUDIES OF BERYLLIUM. Weissmann, S.; Kannan, V. C. (Rutgers–The State Univ., New Brunswick, NJ). pp 484-493 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Application of the synergy method to the deformation of zone-refined beryllium single crystals oriented for prism slip showed that there existed a columnar growth substructure which determined the response of the crystal to subsequent deformation. The interaction of basal slip dislocations with inactive, ingrown dislocations lead to a deformation substructure that ultimately assumed at the surface the configuration of a longitudinal cell structure. The severe restriction imposed by this structure on lateral rotation of lattice domains is believed to be responsible for the resulting fracture. Pre-strained specimens gave rise to the immediate development of this cell structure and hence to rapid fracture. (auth)

28233 AVOIDANCE OF SOFTENING IN DILUTE Cu–Zr ALLOYS. Sohl, C. E.; Kidron, A.; De Angelis, R. J. (Univ. of Kentucky, Lexington). pp 494-504 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Based on the results of investigation, the resistance of softening of dilute Cu–Zr alloys is proposed to be solute atom pinning of dislocation cell walls. This mechanism leads to retardation of cell coalescence and formation of mobile high-angle boundaries. (auth)

28234 ANALYSIS OF MICROSTRUCTURES IN NICKEL-BASE ALLOYS: IMPLICATIONS FOR STRENGTH AND ALLOY DESIGN. Oblak, J. M.; Kear, B. H. (Pratt and Whitney Aircraft, Middletown, CT). pp 566-616 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The application of transmission electron microscopy has been invaluable to the understanding of high-temperature nickel-base alloys. Analysis of precipitation and deformation processes in these alloys has required a thorough and detailed use of electron-diffraction contrast theory and at times provided contributions to theory. The results of such studies have led to a predictive understanding of factors contributing to yield and creep strength. These should serve as guidelines for future alloy design. (auth)

28235 MICROSTRUCTURE–MECHANICAL PROPERTY–FRACTURE RELATIONSHIPS IN THE ALL-BETA TITANIUM ALLOY Ti–13V-11Cr–3Al. Narayanan, G. H.; Archbold, T. F. (Univ. of Washington, Seattle). pp 657-666 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The mechanical properties and the fracture behavior of the all-beta alloy Ti–13V–11Cr–3Al were studied in relation to the microstructural characteristics of the alloy. The deformation substructures developed during plastic deformation were examined to establish the strengthening mechanisms in this alloy. (auth)

28236 USE OF AN ALLOTROPIC PHASE CHANGE TO ENHANCE DUCTILITY IN Fe–Ta ALLOYS. Jones, R. H.; Parker, E. R.; Zackay, V. F. (Univ. of California, Berkeley). pp 829-838 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The brittle fracture characteristics of two-phase Fe–Ta alloys were converted to that of ductile fracture by utilizing the $\alpha \rightarrow \gamma$ transformation. The change in grain size, grain-boundary precipitate, and matrix precipitate was studied with scanning electron microscopy, electron microscopy, electron-beam microprobe analysis, and optical microscopy. The final structure was a dispersion of nearly spherical particles in a bcc iron matrix. The particles were the Laves-phase ($MgZn_2$ type, C14) Fe_2Ta and were about 0.20 μ in diameter. Alloys containing approximately 3 and 6 vol % were studied. Uniaxial tensile properties were measured at room temperature and elevated temperatures up to 700°C. Also, the room temperature properties of these alloys after an anneal at 700°C were measured and showed an initial softening but thereafter remained constant up to 100 hours, the longest test conducted. (auth)

28237 STABILITY OF THE W + 5% Re/W + 20% Re THERMOCOUPLE IN AN ARGON ATMOSPHERE. Oleinikova, L. D.; Oleinikov, P. P.; Trakhtenberg, L. I. pp 27-31 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The stability of the thermocouple W + 5% Re/W + 20% Re was investigated in an argon atmosphere over the temperature range 1300 to 2000°C. The source of instability of this thermocouple proved to be the processes associated with changes in the alloy microstructure. The accuracy of protracted measurements at high temperature depended largely on the temperature at which the alloy was homogeneously annealed. The annealing temperature should be selected with the anticipated operating temperature in mind. (KSW)

28238 HIGH-TEMPERATURE MEASUREMENT WITH TUNGSTEN–RHENIUM THERMOCOUPLES. Stadnyk, B. I.; Lakh, V. I. pp 32-39 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

Four W–Re compositions were studied with respect to their performance as electrodes in thermocouple applications: tungsten with 5, 10, 15, and 20% Re, respectively. X-ray structural and chemical analyses were conducted following various periods of "soaking" at 1500°C in refractory oxides such as Al_2O_3, MgO, ZrO_2, and BeO, at 1200°C in N_2, 1800° in H_2, and at 2000°C in Ar and in a vacuum. When the work was conducted in a vacuum in a furnace with a graphite heater, W_2C was formed from the α-solid solution of Re in W. (KSW)

28239 MEASUREMENT OF THERMAL EXPANSION ON REFRACTORY METALS AT ELEVATED TEMPERATURES BY AN ABSOLUTE METHOD. Neimark, B. E.; Brodskii, B. R. pp 76-80 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The coefficients of linear expansion of Nb, Ta, Mo, and W were determined at 100 to 1600°C using a vacuum dilatometer. The elongation of the sample was measured by an absolute method using a horizontal microscope. The values obtained agreed satisfactorily with those of the literature. (KSW)

28240 HIGH-TEMPERATURE INVESTIGATIONS OF SOLID BODIES AND THE PHYSICS OF HIGH PRESSURES. Ivanov, B. N. pp 156-164 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

Data on the impact compression of metals and the thermodynamic approach were employed to establish a relationship between coefficients of anharmonicity and elastic pressure. Anharmonicity calculations facilitated the derivation of a high-temperature equation of state for tungsten and copper, and the consequent prediction of the heat capacities and thermal expansion data which agree with the experimental values. (KSW)

28241 THERMODYNAMIC PROPERTIES OF THE ALLOYS OF HEAT-RESISTANT METALS WITH IRON-GROUP METALS AT TEMPERATURES ABOVE 1000°C. Rezukhina, T. N.; Drobyshev, V. N. pp 197-206 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The thermodynamic properties of Mo and Nb were investigated by means of emf measurements of cells formed from the systems Mo–Co, Nb–Co, and Nb–Fe with solid oxide electrolytes at temperatures above 1000°K. The values for $-\Delta H^{\circ}_{298}$, $-\Delta G^{\circ}_{298}$, and S°_{298} as obtained for $Mo + O_2 \rightarrow MoO_2$ were: 140.4 kcal/mole, 127.1 kcal/mole, and 11.33 eu/mole; for $Nb + \frac{1}{2} O_2 \rightarrow NbO$ were: 99 kcal/mole, 93 kcal/mole, and 12 eu/mole. (KSW)

28242 ELECTRICAL RESISTANCE OF REFRACTORY METALS ABOVE 1200°K. Timrot, D. L.; Voskresenskii, V. Yu.; Peletskii, V. E. pp 326-334 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The apparatus described for measurement of electrical resistance of metals at elevated temperatures can handle a small rod-shaped sample 8 to 14 mm in diameter and about 60-mm long. Uniform heating of the sample is accomplished by electron bombardment. Resistance measurements were made on samples of Nb, Ta, Mo, and single crystals of Mo between 1200 and 2900°K. (KSW)

28243 THERMAL CONDUCTIVITY COEFFICIENTS AND THE INTEGRAL DEGREE OF BLACKNESS OF REFRACTORY METALS ABOVE 1000°C. Timrot, D. L.; Peletskii, V. E.; Voskresenskii, V. Yu. pp 335-345 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

An apparatus was developed for more precise measurement of thermal conductivities of refractory metals and their alloys at elevated temperatures. Thermal conductivity coefficients were measured in the general range of 1300 to 2900°K for the following materials: Ta, Nb, Hf, polycrystalline Mo, and single crystals of Mo. The same five metals were used in a determination of the integral, hemispherical degree of blackness at the same temperatures. The heat conductivity and blackness data were in turn used to compute Sadykov's constants for the identical five samples. (KSW)

28244 VISCOSITY AND SPECIFIC ELECTRICAL RESISTANCE OF LIQUID ALLOYS OF GALLIUM WITH SILVER, INDIUM, TIN, LEAD, AND BISMUTH. Kononenko, V. I.; Yatsenko, S. P. pp 385-390 of Teplofizicheskie svoistva tverdykh tel pri vysokikh temperaturakh. Tom I. Novikov, I. I. (ed.). Moscow; Izdatel'stvo Komiteta Standartov, Mer i Izmeritel'nykh Priborov pri Sovete Ministrov SSSR (1969). (In Russian).

From all-union conference on the physical properties of matter at high temperatures; Novosibirsk, USSR (25 Jul 1966). See CONF-660733--.

The kinematic viscosity and specific electrical resistance of a number of Ga alloys were determined by a combined electrode-less method. The binary alloys investigated contained Ga plus one of the following metals: Ag, In, Sn, Pb, and Bi. Correlations were noted in the "property–composition" and melting point diagrams of the alloys Ga–In and Ga–Sn. The system Ga–Ag may contain a eutectic composition with <1 at. % Ag. The μ-form dependence of the decrement of attenuation of vibrations of the crucible with the melt on the temperature in systems with limited solubility of the components in the liquid state was established. The temperature limits of the region of limited solubility were confirmed in the systems Ga–Pb and Ga–Bi. (KSW)

28245 PHYSICAL CHEMISTRY, SERIES ONE. Volume 6. Electrochemistry. Bockris, J. O. MTP International Review of Science. Baltimore; University Park Press (1973). 338p. $24.50.

Information on electrochemical methods and parameters is presented in six chapters. A separate abstract was prepared for one chapter. The five other chapters are not in the scope of NSA. (JRD)

For an abstract of an individual chapter see: 28246.

28246 SOME RECENT ADVANCES IN THE STUDY OF HYDROGEN IN METALS. Subramanyan, P. K. (Gould Labs., Cleveland). pp 181-238 of Physical Chemistry, Series One. Vol. 6. Bockris, J. O. (ed.). Baltimore; University Park Press (1973).

Results of electrochemical studies of hydrogen-metal systems are summarized. Information is included on experimental methods, hydrogen partial molar volume determinations, dissolved hydrogen in metals, hydrogen embrittlement of metals, and selected experimental results. (146 references) (JRD)

28247 EFFECTS ON HOLD TIME ON LOW-CYCLE FATIGUE BEHAVIOR OF AISI TYPE 304 STAINLESS STEEL AT 593°C. Cheng, C. Y.; Diercks, D. R. (Argonne National Lab., IL). Met. Trans.; 4: No. 2, 615-617(Feb 1973).

Results of low-cycle fatigue tests show that zero hold time in the tests yields longer fatigue life. This indicates the beneficial effects of the compressive state of stress on retarding the crack-initiation process. Low-cycle fatigue data for 304 stainless steel at 593°C are presented graphically. (JRD)

28248 PSEUDOELASTICITY AND THE STRAIN-MEMORY EFFECT IN AN Ag–45 AT. PERCENT Cd ALLOY. Krishnan, R. V. (Katholieke Univ., Leuven, Belgium); Brown, L. C. Met. Trans.; 4: No. 2, 423-429(Feb 1973).

Pseudoelasticity and the strain-memory effect were studied in β Ag–Cd alloys having a low-temperature martensitic transformation. Tests on single crystals showed that maximum pseudoelasticity occurred in specimens with the tensile axis oriented close to $\langle 001 \rangle_{\beta}$ at temperatures 20 to 50°C above M_s. The habit plane for stress-induced martensite (SIM) was found experimentally to be $\sim(155)_{\beta}$ and agreed well with a value obtained from the phenomenological theory assuming a $(110)[1\bar{1}0]_{\beta}$ lattice-invariant shear. It is suggested that the macroscopic shear accompanying the transformation gives rise to the pseudoelastic strains, agreement with the experimental strain values being satisfactory. The strain-memory effect was explained as being due to a change from the $(011)[0\bar{1}1]_{\beta}$ lattice-invariant shear associated with thermal martensite to the $(110)[1\bar{1}0]_{\beta}$ shear associated with SIM. (auth)

28249 VANADIUM–PLATINUM CONSTITUTION DIAGRAM. Waterstrat, R. M. (National Bureau of Standards, Washington, DC). Met. Trans.; 4: No. 2, 455-466(Feb 1973).

The system V–Pt was investigated over the entire composition range by metallography, x-ray-diffraction, and electron-microprobe studies. There are at least four equilibrium intermediate phases in this system, and they are stable to progressively higher temperatures with increasing vanadium concentration. The phases which have been observed are: γ', cubic, Cu_3Au type; θ, tetragonal, $TiAl_3$ type; δ, orthorhombic, $MoPt_2$ type; ζ, orthorhombic, AuCd type; and β, cubic, Cr_3Si type (A15). The γ' phase is possibly metastable. A very stable ribbon-like growth of ζ phase in the fcc platinum terminal solid solution has been observed in alloys containing about 43 at. % V. The platinum terminal solid solution forms a congruent melting maximum at about 1805°C. A eutectic reaction occurs at 1720 ± 10°C and a peritectic reaction is indicated at 1800 ± 10°C. Vanadium is soluble in the fcc platinum terminal solid solution up to about 57 at. % at 1720°C. Platinum dissolves only to the extent of about 12 at. % at 1800°C in bcc α-V. (auth)

28250 SHORT-TIME CREEP-RUPTURE PROPERTIES OF LAMP WIRE. Pugh, J. W. (General Electric Co., Cleveland). Met. Trans.; 4: No. 2, 533-538(Feb 1973).

Short-time tensile creep-rupture tests were made on 7-mil lamp filament wire and on 7-mil undoped tungsten wire in the temperature range 2500 to 3100°K. Steady-state creep rate was described by an expression having the form: $\dot{\epsilon} = AD(\sigma/E)^m$, where A is a constant, D is the self-diffusion coefficient, σ is the creep stress, E is the elastic modulus, and m is 5 for undoped tungsten and 25 for lamp-grade wire. Activation energy for time to failure of lamp wire was found to vary from 150 to 185 kcal in the range 2500 to 3100°K. Failure mode in this range was slip at high stresses and intergranular brittle fracture at low stresses. The very high creep strength observed for lamp wire is attributed to a combination of resistance to diffusional creep at low stresses and resistance to dislocation creep at high

stresses. The dispersoid structure of lamp wire is suggested as the origin of strength in both cases. (auth)

28251 ABSENCE OF AN ALLOTROPIC TRANSFORMATION IN PURE VANADIUM AT HIGH TEMPERATURES. Barnes, G. (Univ. of Nevada, Reno). Met. Trans.; 4: No. 2, 549-551(Feb 1973).

Field-electron emission techniques show that an allotropic transformation does not occur in vanadium at high temperatures if the samples are of high purity. Such purity can be obtained by heating for a sufficiently long time in a high vacuum or by zone refining. (auth)

28252 EXTENDED DUCTILITY IN BERYLLIUM. Heiple, C. R. (Dow Chemical Co., Golden, CO). Met. Trans.; 4: No. 2, 585-588(Feb 1973).

Fine grained ingot-source beryllium exhibits extensive ductility near 700°C at strain rates between 5×10^{-5}/s and 5×10^{-4}/s. Elongations of approximately 100% and strain rate sensitivities as high as 0.9 were measured in 16 μm grain size beryllium sheet under these conditions. The high ductility and high strain rate sensitivity in ingot-source beryllium involves a substantial grain boundary sliding contribution to the deformation process at high temperatures and moderately low strain rates. The deformation can probably be characterized as superplastic even though the elongation observed is low compared with that seen in other superplastic materials. Fine-grained, powder source beryllium did not show high ductility under similar conditions, presumably because of the high oxide content. (auth)

28253 CHEMISORPTION ON TUNGSTEN CRYSTAL PLANES. Wise, H. (Stanford Research Inst., Menlo Park, CA). p 240 of Physical Chemistry, Series One. Vol. 7. Kerker, M. (ed.). Baltimore; University Park Press (1972).

Data and information on the interactions of various gases with W surfaces of different crystal orientations are reviewed. Information is included on covalent absorption of CO, H, and N on W. (49 references) (JRD)

28254 MOLYBDENUM INFLUENCE ON HIGH-TEMPERATURE NIOBIUM CREEP. Lazarev, E. M.; Ugaste, Yu. E. Probl. Proch. Mashinostr.; No. 3, 54-56(Mar 1972). (In Russian).

Measurements of prolonged high-temperature hardness, torsion, and stretching were used to evaluate high-temperature creep in Nb–Mo alloys (from 15 wt.% Mo) in the temperature range 1100 to 1500°C in a vacuum. The activation energy of sustained high-temperature creep was obtained, and was found to correlate well with diffusion values in the Nb–Mo system. The dependence of creep rate of these alloys on stress was a power function. In the concentration range tested, the alloying of Nb by Mo increased the resistance to creep of the solid solutions. (tr-auth)

28255 MECHANISM OF THE EFFECT OF RARE EARTH ELEMENTS ON THE OXIDATION OF REFRACTORY METALS. Larikov, L. N.; Maksimenko, E. A.; Tyshkevich, V. M. pp 103-108 of Redkozemel'n. Met. i Splavy. Moscow; Izdatel'stvo Nauka (1971). (In Russian).

X-ray studies were conducted into the effects of alloying (with Y and La) on the oxidation of Cr and Mo in air at high temperature. The oxidation rate for metallo-ceramic Mo was higher, and that for Mo–La alloys lower, than for single crystal Mo. The rate for Cr–Y alloys was appreciably lower than that for Cr over the whole temperature range and for all heating times. The subscale layer of Cr contained oxides and nitrides of Cr, mainly as Cr_2N, which extended for a significant depth into the metal, e.g. to 650 μm after 9 h at 1450°C. The subscale on Cr was very fine-grained and of increased hardness, whereas this effect was determined to be absent in Cr–Y alloys. The increased hardness of the subscale is due to the highly dispersed nature of the metal oxide and nitride precipitates. (Metals Abstr.)

28256 NIOBIUM: A CANDIDATE FOR SPACE VEHICLES. Schussler, M. Precis. Metal; 30: No. 8, 29-32(Aug 1972).

Niobium alloys Nb–1 Zr, B–66, FS–85, C–103, C–129Y, FS–291, Nb–752, and Nb–48Ti are available for nuclear, aerospace, and superconductor applications. Uses will probably include jet engine burner tunnels, skins of hypersonic missiles, aircraft nuclear propulsion units, leading edges on missiles, gas turbine afterburners, and fast reactor fuels. Fused silicide coatings appear to give the best oxidation resistance to unalloyed Nb and the ductile Nb alloys. A table lists the yield stress, ultimate strength, elongation, and yield stress to density ratio of B–66, FS–85, C–129Y, and Nb–752 alloys in sheet form at 75 and 2200°F. (Metals Abstr.)

28257 YTTRIUM AND LANTHANUM SOLUBILITY IN CHROMIUM. Svechnikov, V. M.; Kobzenko, G. F.; Kireev, M. V.; Ivanchenko, V. G. (Inst. of Metal Physics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 2, 167-171(1973). (In Ukrainian).

Cast and annealed Cr–Y and Cr–La alloys were studied by the methods of metallographic, differential thermal, and durometric analyses. Yttrium and lanthanum solubilities in chromium were determined within a temperature range of 1200 to 1800°C. Parts of phase diagrams are plotted. (auth)

28258 X-RAY INVESTIGATION OF THE SYSTEM Dy–Fe–Al IN THE REGION OF 0 TO 33.3 AT. % DYSPROSIUM. Vivchar, O. I.; Zarechnyuk, O. S.; Ryabov, V. R. (Lvov State Univ.). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 2, 159-161(Feb 1973). (In Ukrainian).

By means of x-ray analysis the ternary system Dy–Fe–Al was studied in the range of 33.3 at. % Dy. The isothermal section (500°C) was plotted. In this region there are four ternary compounds: $DyFe_{4.0\rightarrow5.6}Al_{8.0\rightarrow6.4}$ (ψ phase, $ThMn_{12}$ type); $Dy_2Fe_{9.0\rightarrow11.}Al_{8.0\rightarrow6.0}$ (φ_2 phase, Th_2Zn_{17} type); $DyFe_{1.2}Al_{0.8}$ (λ_1 phase, $MgZn_2$ type) and $DyFe_2Al_{10}$ (ψ' phase, unknown structure); and three solid solutions based on the binary compounds $Dy_2Fe_{17.0\rightarrow12.0}Al_{0\rightarrow5.0}$ (φ_1 phase, Th_2Ni_{17} type); $DyFe_{2.0\rightarrow1.4}Al_{0\rightarrow0.6}$ and $DyAl_{2.0\rightarrow1.2}Fe_{0\rightarrow0.8}$ ($\lambda_{2(Fe)}$ and $\lambda_{2(Al)}$ phases, $MgCu_2$ type). (auth)

28259 TUNGSTEN NEWS, JANUARY 1973. Tungsten News; 1-18(Jan 1973).

Research and development activities in W technology are reviewed. Information is included on properties and uses of W metal, properties and uses of tool materials composed of refractory W compounds, properties of W-base alloys and composites, and properties of refractory W compounds other than carbides. (376 references) (JRD)

28260 ENHANCEMENT OF THE CREEP RESISTANCE OF METALS. Kramer, I. R.; Balasubramanian, N. (Martin–Marietta Corp., Denver). Met. Trans.; 4: No. 2, 431-436(Feb 1973).

It is shown that the presence of an unstable surface layer has a very marked effect on the creep behavior of metals. By eliminating this surface layer the creep rate can, for example, be reduced by a factor of 38 for 321 steel tested at 1400°F at 60% of the proportional limit. By eliminating the surface layer, activation energy for creep was increased by 13, 21, and 49 kcal/mole for Haynes 188, titanium (6 Al–4 V), and 321 steel, respectively. This change indicates that two mechanisms control the creep process. (auth)

28261 MOLYBDENUM: A METAL WITH A FUTURE. VII. Young, C. O. Precis. Metal.; 30: No. 9, 59-61(Sep 1972).

Methods of consolidating Mo metal powder into ingots are described: vacuum arc casting and press-sinter. The brittle–ductile transition temperature effects and the weak intergranular bonds are discussed in relation to fabrication of wrought parts. Mine output figures are cited. (Metals Abstr.)

28262 ANOTHER INDICATED PHASE TRANSFORMATION IN YTTERBIUM. Hurd, C. M.; Alderson, J. E. A. (National Research Council of Canada, Ottawa). Solid State Commun.; 12: No. 5, 375-377(1 Mar 1973).

The electrical resistivity of polycrystalline samples of Yb showing the fcc-hcp transformation has been determined in the range 300 to 1088°K. Three anomalous features are observed: first, a hysteric and reversible transformation is indicated at about 560°K. Second, a sharp discontinuity in the temperature dependence of the resistivity is observed at about 660°K, and, third, a discontinuous transition is observed at about 970°K. The latter is tentatively attributed to the onset of the bcc phase in material of this purity, but since no high-temperature x-ray investigation has been possible, no certain interpretation of any of these features can presently be given. (auth)

28263 TRANSFERENCE NUMBERS OF NICKEL AND MOLYBDENUM IN THEIR BINARY ALLOYS. Kalinovich, D. F.; Kovenskii, I. I.; Smolin, M. D. (Inst. of Problems in Materials Studies, Kiev). Ukr. Khim. Zh.; 39: No. 1, 37-40(Jan 1973). (In Russian).

The transference numbers of Ni and Mo were determined in alloys of these metals with 8, 16, 18, 20 and 23 at.% Mo at 950 to 1400°C in a constant electrical field. The radioisotopes ^{63}Ni and ^{99}Mo were used in these measurements. The numbers for partial transfer of ions of both kinds were calculated. The direction of migration was determined by the effect of scattering of current carriers by ions. (tr-auth)

28264 VAPOR PRESSURE OF RUBIDIUM AND DISASSOCIATION ENERGY OF Rb_2. Piacente, V.; Bardi, G.; Malaspina, L. (Univ. Rome). J. Chem. Thermodyn.; 5: No. 2, 219-226(Mar 1973).

The vapor pressure of liquid rubidium in the temperature range 402 to 551°K was determined by thermogravimetric and mass-spectrometric techniques. The value (19.0 ± 0.5) $kcal_{th}$ mol^{-1} is

proposed for the evaporation enthalpy of the element at 298.15°K. The disassociation energy $D^0(T = 0) = (10.0 \pm 0.5)$ $kcal_{th}$ mol^{-1} of the Rb_2 molecule was also determined. (auth)

28265 SUPERPLASTICITY OF METALS AND ALLOYS. Misiolek, Z.; Turon, J. Rudy Metale Niezelaz.; 16: No. 12, 587-591(Dec 1971). (In Polish).

A review is presented of world literature on studies of superplasticity of metals with particular attention to Al–Zn alloys also mentioning Al–Mg, Al–Cu, Cu–Mg, Cu–Zn, Cu–Ni, Pb–Sn, Ti–Al–Sn, Ti–Al–V, Bi–Sn, Cd–Zn, Ni–Fe–Cr, and Mg–Zn–Cr. The mechanism of superplasticity is attributed to phenomena at phase boundaries during phase transformation. Comments are made on the potential advantage of utilizing these phenomena in view of the almost unlimited formability of correctly heat-treated semi-products made of the selected alloys. 46 references. (Metals Abstr.)

Radiation Effects

Refer also to abstracts 27424 and 28110.

28266 LOW-TEMPERATURE CREEP OF LEAD CRYSTALS DURING IRRADIATION. Troitskii, O. A.; Spitsyn, V. I.; Glazunov, P. Ya.; Gusev, E. V. (Inst. of Physical Chemistry, Moscow). Dokl. Akad. Nauk SSSR; 207: No. 4, 834-837(1 Dec 1972). (In Russian).

The effect of electron beams with energies below the knock-out threshold of atoms on the process of creep of metals was studied at low temperatures. Crystals of Pb 1 × 16 mm were deformed and irradiated at liquid nitrogen temperatures with electrons of energies 0.1, 0.55, 1.1, and 1.65 MeV. As a result of the electron excitation, a decrease in the critical stresses of displacement occurred as compared with nonirradiated specimens. (KSW)

28267 KILOVOLT ELECTRON ENERGY DISSIPATION VS. PENETRATION DISTANCE IN HIGH ATOMIC NUMBER MATERIALS. Chung, M. S.; Devore, W. J.; Everhart, T. E. (Univ. of California, Berkeley). pp 171-187 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

The energy loss/unit penetration depth was estimated using certain assumptions to reduce measured values of electron beam-induced currents across a thin insulator (Ta_2O_5) sandwiched between a tantalum substrate and a thin gold evaporated film. A computer program was developed to reduce the experimental data by making a least-squares fit to either a polynomial expansion or a shifted gaussian function. The resulting energy dissipation profile can be used to calculate the (mobility μ) × (lifetime τ) of the excited electrons in the oxide, divided by the mean energy of activation, E_A. This same parameter can be calculated by an independent check expression also. These two independent values are compared as a check on the experiment. (auth)

28268 STUDY OF POINT-DEFECT INTERACTIONS WITH DISLOCATIONS BY MEANS OF HIGH-VOLTAGE MICROSCOPY. Urban, K.; Milkens, M. (Max-Planck-Institut fuer Metallforschung, Stuttgart). pp 929-951 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

A high-voltage electron microscope was used to produce and observe the effect of radiation damage in nickel at elevated temperatures in order to study the interaction of migrating point defects with dislocations and dislocation loops. Frank loops of interstitial type dominated in the entire temperature range from 200 to about 600°C. Below 420°C vacancy loops were found inside the interstitial loops. Under particular conditions the formation of stacking-fault tetrahedra and voids were observed. The predominant formation of interstitial loops is attributed to a competing diffusion of the point defects to the foil surfaces and to the dislocations, the latter are assumed to be more attractive for interstitials than for vacancies. From the fact that under steady-state conditions the growth rate of interstitial loops is independent of their diameter it is concluded that a dislocation causes only a localized perturbation of the distribution of point defects. The temperature dependence of the growth rate as calculated by solving the steady state diffusion equations for a simplified model is in reasonable agreement with the experimental observations. The formation and limited size of vacancy loops on the compression side of edge dislocations are attributed to the spatial separation of vacancies and interstitials in the strain field of the respective dislocation. Unlike the vacancy loops, the voids are not limited in size since they act as vacancy sinks, as do free surfaces, in competition with dislocations. (auth)

28269 ELECTRON-IRRADIATION EFFECTS ON THE STRUCTURE OF COPPER AND ALUMINUM. Meshii, M. (Northwestern Univ., Evanston, IL); Shiraishi, K. pp 952-963 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

A study was made of the structural changes produced in copper and aluminum by 1000-kV electrons in a high-voltage electron microscope. The secondary defects resulting from the clustering of the irradiation-induced point defects were formed under various conditions. Results of analyses concerning the effects of the specimen temperature and the pre-existing dislocation loops indicated that the clustering was controlled by the nucleation in both metals. The nucleation occurred heterogeneously in copper, while it appeared to occur homogeneously in aluminum. Interstitial clustering was identified in copper and vacancy clustering was noted in aluminum. The observations were examined in conjunction with information on the recovery of irradiation damage and the clustering of vacancies in quenched metals. (auth)

28270 RADIATION-INDUCED DISTORTION AND SWELLING OF MAGNESIUM. Sturcken, E. F.; Krapp, C. W. (E. I. du Pont de Nemours and Co., Aiken, SC). pp 996-1016 of Electron Microscopy and Structure of Materials. Thomas, G. (ed.). Berkeley and Los Angeles, CA; Univ. of California Press (1972).

From fifth international materials symposium on the structure and properties of materials-techniques and applications of electron microscopy; Berkeley, California, USA (13 Sep 1971). See CONF-710916.

Pure magnesium irradiated to 3×10^{22} neutrons/cm^2 of $E > 0.1$ MeV underwent swelling, severe distortion, and deterioration of mechanical properties. Transmission and scanning electron microscopy showed that the swelling was caused by hexagonal voids, stacking faults on the basal planes, and intergranular cavities. The grain distortion and intergranular cavities were caused by anisotropic irradiation growth. Additions of Al, Sn, Ca, and Ce to magnesium prevented irradiation damage. The alloys prepared with these elements had low neutron cross sections, good mechanical properties, and improved corrosion resistance compared with commercial magnesium alloys. (auth)

28271 CHANGES IN MAGNETIC PROPERTIES OF MOLYBDENUM PERMALLOY DURING NEUTRON IRRADIATION. Artsishevskii, A. I.; Zusman, A. I.; Kemers, R. Ya.; Selisskii, Ya. P.; Ulmanis, U. A. Sb. Tr. Tsent. Nauch.-Issled. Inst. Chern. Met.; No. 78, 33-39(1971). (In Russian).

Specimens of an Fe–79%Ni–4.5%Mo alloy were subjected to neutron irradiation (up to 3×10^{16} neutrons/cm^2) at 10 to 300°C, both in the presence and absence of a magnetic field. Their magnetic properties were studied during annealing at temperatures from 200 to 500°C after the irradiation and heat treatment. With no magnetic field, an increase in neutron flux resulted in a fall in permeability, μ_{max}, and residual induction, B_r, and an increase in H_c; the hysteresis loop had a shape typical of Perminvar. With low neutron flux in a magnetic field there was an increase in μ_{max} and B_r and a marked decrease in H_c, i.e. ~50%; the hysteresis loop became rectangular. Increasing the neutron flux above a certain critical value gave a peak on the μ_{max} and a minimum on the H_c curves. With increase in temperature the critical value decreased. The nature of the H_c changes during irradiation was analogous to those during low-temperature annealing. A post-radiation anneal removed the disparity in properties of specimens irradiated with and without magnetic field. (Metals Abstr.)

Other Materials

Refer also to abstracts 27563, 27781, 28118, 28130, 28143, 28144, 28147, 28245, 28246, 28253, 28386, and 29483.

28272 (BARC-627) DIFFUSE REFLECTANCE SPECTRA OF RARE-EARTH-DOPED CALCIUM FLUORIDE. Luthra, J. M.; Sathyamoorthy, A. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 15p. Dep. NTIS (U. S. Sales Only).

The usefulness of the relatively new method of diffuse reflectance

spectroscopy in the study of inorganic phosphors was shown by studying CaF_2 doped with rare earth impurities. The reflectance spectra were recorded before and after ^{60}Co γ irradiation in the region 200 to 800 nm. The spectra are interpreted on the basis of electronic transitions of rare earth ions. (auth)

28273 (DP-Report-643) MEASUREMENT OF THE PHYSICAL AND MECHANICAL PROPERTIES OF PRESSED GILSOCARBON GRAPHITE (DRAGON REF. 95). Dragon Project. Gateau, M. (Sud-Aviation S. A., Paris (France)). Jun 1969. 80p. Dep. NTIS (U. S. Sales Only) $6.00.

For Atomic Energy Establishment, Winfrith, Eng.

Initial physical and mechanical properties have been measured for production quality pressed Gilsocarbon graphite of full block size (16 in. diameter × 33 in. high). Data are given for electrical resistivity, specific heat, thermal conductivity, coefficient of thermal expansion, flexural, tensile and compressive strength, Young's Modulus and Poisson's ratio, for temperatures of up to 1500°C in most cases and in some cases to 2800°C. Experimental methods are briefly described. (auth)

28274 (EURISOTOP-55(Vol. 2), pp 1113-1122) BORONPLASTER, A NEUTRON-ABSORBING MATERIAL. Ertl, H. H.; Bodemann, M.; von Erichsen, L. (Kernforschungsanlage, Juelich, Ger.). 1972. (In German).

From conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A plaster-like material shielding thermal neutrons is described consisting of powdered boric acid (H_3BO_3) and gypsum ($CaSO_4$). It combines the neutron absorbing effect of boron with the consistency of plaster. Some chemical and physical properties of this material are described. Its calculated absorption effect is confirmed by experimental data achieved with a neutron generator. (auth)

28275 (INIS-mf-97) INSULATING AND PROTECTIVE MATERIALS IN NUCLEAR ENGINEERING. Rotrekl, B.; Svoboda, B. 6p. (In Czech). (CONF-701214-11). INIS.

From 5th conference on nuclear power; Piestany, Czechoslovakia (1 Dec 1970).

The main applications of plastics in the construction of nuclear power stations are reviewed. Protective paints and floorings designed for active parts of the stations are dealt with. (INIS)

28276 METHOD OF ELECTROLYTIC POLISHING OF RARE EARTH METALS AND THEIR ALLOYS. Terekhova, V. F.; Kulakov, Yu. A.; Savitskii, E. M.; Shelkova, I. G. Russian Patent 305,203. 13 Jul 1971. Filed date 27 Jan 1970. (In Russian).

A method of electrolytic polishing of rare earth metals and their alloys in an electrolyte containing HNO_3 and glycerin, differing in that in order to improve the quality of polishing of yttrium and its alloys, oxalic acid is introduced to the electrolyte in the following ratio of components, wt %: HNO_3 40 to 50, oxalic acid 20 to 40, glycerin remainder, and the process is conducted at 20°C and D = 1.5 to 3 A/cm^2. (JPRS)

28277 PHYSICAL CHEMISTRY, SERIES ONE. Volume 7. Surface Chemistry and Colloids. Kerker, M. (ed.). MTP International Review of Science. Baltimore; University Park Press (1972). 312p. $24.50.

Advances in colloid and surface chemistry are reviewed in eight chapters. A separate abstract was prepared for one chapter. The other seven chapters are not in the scope of NSA. (JRD)

For an abstract of an individual chapter see: 28253.

28278 EFFECTS OF SAMPLE DIMENSIONS OF STRENGTH OF GRAPHITE MATERIAL IN COMPRESSION AND BENDING. Plutalova, L. A.; Rotnitskii, G. S. Mashinovedenie; No. 5, 80-85 (1970). (In Russian).

The influence of sample dimensions on strength of graphite material was investigated in compression and bending. Tests were carried out for cylindrical samples in compression and for square cross section in bending. It is shown that strength of the tested material decreases with increase in the area of the cross section of specimen and this effect is stronger in bending than in compression tests. The information is of interest to workers in the field of experimental mechanics. (Appl. Mech. Rev.)

28279 EFFECT OF RADIATION DOSES ON POLYPROPYLENE FOIL. Varsanyi, I.; Kiss, I.; Farkas, J. Acta Aliment.; 1: No. 1, 5-16(1972).

Polypropylene foil, used as packaging material for radiation-preserved pork cuts, was examined for structural and mechanical changes caused by gamma radiation. Foil samples exposed to 0.50, 100, 200, 400, 600, 700, and 800 krad were investigated by infrared and ultraviolet spectrophotometry and tested for tensile strength and elongation. Evaluation of the infrared and ultraviolet spectra showed statistically insignificant changes, both in infrared light transmission and ultraviolet light absorption due to exposure to about 800 krad, lying in the 5 to 10% range. Exposure at levels up to 600 krad did not significantly alter the tensile strength of the foil; however, 700 to 800 krad caused ~20% reduction of the tensile strength. A notable increase of elongation at rupture was observed even at a 400-krad level. Nonoriented polypropylene foil treated on one side for printing purposes appears to be suitable for packing meat treated with radiation-pasteurizing exposures to gamma radiation, since levels of 800 krad or less did not significantly alter the proportion of the atactic-isotactic regions. (Hung. Tech. Abstr.)

28280 CONTROLLED-ATMOSPHERE ELECTRON MICROSCOPY STUDIES OF GRAPHITE GASIFICATION. 1. The Catalytic Influence of Zinc. Baker, R. T. K.; Harris, P. S. (Atomic Energy Research Establishment, Harwell, Eng.). Carbon; 11: No. 1, 25-31(Feb 1973).

The catalytic activity of zinc in the gasification of single crystals of graphite has been studied by a controlled-atmosphere electron-microscopy technique. Continuous observation showed that catalyst particles are only active when in contact with steps on the cleavage surface of the graphite crystal and cut channels into the steps. Quantitative estimates of channel propogation rates as a function of oxygen pressure and temperature have been obtained. It is suggested that the catalyst composition is close to ZnO. (auth)

28281 BEHAVIOR OF GRAPHITE UNDER BIAXIAL TENSION. Greenstreet, W. L.; Yahr, G. T.; Valachovic, R. S. (Oak Ridge National Lab., TN). Carbon; 11: No. 1, 43-57(Feb 1973).

A small-deformation elastic-plastic continuum theory for describing the stress-strain behavior of graphite is examined for specimens under biaxial loading at room temperature. The continuum theory takes into account the anisotropy and plastic compressibility of graphite as well as the continuous nonlinearity of the stress-strain response. The measured strains for thin-walled cylindrical shells loaded by internal pressure are shown to agree very closely with the predictions of the theory for both loading and unloading. (auth)

28282 ULTRASONIC CHARACTERIZATION AND COMPUTERIZED ANALYSIS OF GRAPHITE BILLETS. Baker, R. A.; Bishop, D. E.; Stoker, G. C. (Sandia Labs., Albuquerque, NM). Int. J. Nondestruct. Test.; 4: No. 4, 301-341(Mar 1973).

A computer-aided, ultrasonic test system for graphite billets has been developed, the primary purpose of which is to select the optimum location within the billet of a reentry vehicle nose tip. An on-line mini-computer provides process control functions and initial data processing. Further data processing and billet quality analysis are provided by a large computer. Visualization of the internal structure is aided by the use of a computer-controlled plotter. The ultrasonic test system consists of a commercial ultrasonic tester with an automatic scanning and immersion system. Position readout indicators provide scan position and part rotation information. A special interface module receives ultrasonic test data from the tester and converts this information to analog voltages, while an auxiliary function module, controlled by the mini-computer, digitizes and records the position and ultrasonic information on magnetic tape. The large computer analyzes the ultrasonic flaw data in terms of the up to 3300 possible nose-tip locations within the billet. In evaluating each particular nose-tip location, every flaw indication is assigned a weight. These weights are totaled for that cone location. The 15 positions having the lowest weights are presented to the design engineer for his final selection. The plotter is used to provide graphic pictures of the flaws within the billet to aid the engineer in his selection of the optimum position of the nose tip. Plots are made showing all of the flaws in the billet by subdividing into slabs which run parallel to the billet axis and into discs perpendicular to the axis. Such plots show the flaw distribution in a clear, concise manner. Further programs plot histograms of the data with respect to three location parameters. (auth)

28283 STRUCTURE AND PROPERTIES OF GRAPHITE-CHROMYL, CHLORIDE LAMELLAR COMPOUND. Takahashi, Y.; Yamagata, H.; Mukaibo, T. (Tokyo Univ.). Carbon; 11: No. 1, 19-24(Feb 1973).

Crystal structure, electric conductivity, and thermal stability of graphite-CrO_2Cl_2 lamellar compound were investigated. X-ray diffraction studies of $C_{27.8}CrO_2Cl_2$ show that it possesses a 3rd-stage lamellar structure with I_c of 14.87 Å. This lamellar compound is unusually stable and its electric conductivity, as well as its composition, show only a slight change after complete evacuation of reacting CrO_2Cl_2 gas. When heat-treated in a vacuum, its electric conductivity shows a considerable decrease, whereas its composition changes very slowly up to 300°C. (auth)

28284 IRRADIATION-INDUCED CHANGES IN THE ORIENTATION ANISOTROPY IN PYROCARBON CLADDING LAYERS OF FUEL-OXIDE PARTICLES. Kolzlik, K. (Kernforschungsanlage, Juelich, Ger.); Koss, P. Atomwirt., Atomtech.; 18: No. 1, 29-31 (1973). (In German)

28285 THERMAL AND ELECTRICAL PROPERTIES OF PYROLYTIC GRAPHITE. Lutkov, A. I.; Volga, V. I.; Dymov, B. K.; Lukina, E. Yu.; Tamarin, P. V. Inorg. Mater. (USSR) (Engl. Transl.); 8: No. 8, 1244-1249(Aug 1972)

Translated from Izv. Akad. Nauk. SSSR, Neorg. Mater.; 8: No. 8, 1409-1416(Aug 1972).

Results of investigations are presented on the thermal conductivity, electrical conductivity, thermal expansion, and heat capacity of commercial graphite with properties virtually the same as those of a natural graphite single crystal. The electronic thermal conductivity at T < 10°K has been investigated. The average size of the defect-free region of the crystal lattice in the direction of the a axis is 15,000 to 18,000 Å. The characteristic temperature of the graphite crystal lattice has been calculated (θ_1 = 200°K, θ_2 = 1200°K). The forbidden-zone width in the direction of the c axis is 0.7 eV. (auth)

28286 CARBON '72. International Conference, Baden-Baden, Germany, June 25, 1972. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). vp. (In German and English). (CONF-720609).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Forty-eight papers are included. Abstracts were prepared for thirty-nine of the papers. The remaining nine were previously abstracted; see NSA 26: 38813, 40086, 40540, 53713, 56754, 56756, and 56758; and NSA 27: 22991 and 22992. (DLC)

For abstracts of individual papers see: 27367, 28185–28190, 28287–28315, 29374, 29404, and 29405.

28287 PYROLYSIS OF MATRIX MATERIALS FOR FUEL ELEMENTS OF HIGH-TEMPERATURE REACTORS. Nickel, H.; Beuck, V.; Luhleich, H.; Pflaum, P. (Kernforschungsanlage, Juelich, Ger.). pp 23-26 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

In connection with the development of suitable compound matrix materials, experiments are being carried out on the coking processes of phenolic formaldehyde binders in a mixture with graphitic fillers. For this purpose, pyrolysis equipment was developed, which permits one to follow up the coking process at the same time by means of TGA, GEA, and MSA. A quantitative GEA was developed for the noncondensable gases being generated during the pyrolysis. The results of the first experimental series are outlined, where due consideration was given to variations of heating speed, sample size, and binder content. (auth)

28288 REACTION OF NUCLEAR GRAPHITES WITH HYDROGEN AT TOTAL PRESSURES BETWEEN 1 AND 40 ATMOSPHERES. Karcher, W.; Glaude, P. (Commission of the European Communities, Petten, Netherlands). pp 71-73 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The reaction of nuclear graphites with hydrogen was investigated in the temperature range of 60° to 1150°C at total pressures between 1 and 40 atmospheres under flow conditions. The hydrogen particle pressures (in argon) were varied between 0.01 and 20 atmospheres. The formation of CH_4 was followed by continuous weight recording and by gas chromatography. In the Arrhenius plots of the resulting CH_4 formation rates, three distinct reaction regimes were observed: the first with a high activation energy at reaction temperatures below 700°C, a second range at intermediate reaction temperatures with about half the initial activation energy, and a third temperature range at elevated reaction temperatures with an apparent negative activation energy, starting between 900 and 1200°C, depending on H_2 particle pressures. (auth)

28289 KINETIC PARAMETERS IN THE CATALYSED GASIFICATION OF GRAPHITE. Harris, P. S. (Atomic Energy Research Establishment, Harwell, Eng.). pp 74-76 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The existence of a relationship between the pre-exponential factor and the activation energy in the Arrhenius equation (compensation effect) for the catalyzed reaction of graphite with CO_2, N_2O, and O_2 is demonstrated using data from a wide variety of sources. A simple model is developed which yields the form of the rate dependence on temperature for graphite impregnated with catalysts and is used to describe the difficulties which this relationship creates. The cases where the relation is not observed are also discussed. (auth)

28290 EFFECT OF PRESSURE ON THE C-AXIS ELASTIC PARAMETERS IN COMPRESSION ANNEALED PYROLYTIC GRAPHITE. Green, J. F.; Spain, I. L. (Univ. of Maryland, College Park). pp 108-111 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Measurements of the elastic stiffness constants C_{33} and C_{44} and their dependence on pressure between 0 and 7 kbar were made on samples of compression-annealed pyrolytic graphite (CAPG) at room temperature. Similar measurements were also made on fast-neutron irradiated CAPG. Theoretical values for these quantities were calculated for the Lennard–Jones and Crowell potentials. Good agreement is found for the compressional mode. The discrepancy between elementary interplanar potential theory and experiment for the modulus C_{44} in CAPG is discussed in terms of elastic, electronic, and electrostatic contributions. (auth)

28291 STRUCTURE AND PROPERTIES OF GRAPHITE-BROMINE RESIDUE COMPOUND AT HIGH TEMPERATURES. Takahashi, Y.; Miyauchi, K.; Mukaibo, T. (Tokyo, Univ.). pp 112-113 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Thermal diffusivity and heat capacity of graphite–bromine residue compound were measured at temperatures from 100 to 600°C, and an anomalous change was found at about 330°C. Around this temperature, the decreasing curve of the thermal diffusivity shows a break, and the heat capacity has a small hump. High temperature x-ray analysis was also performed at the same temperature range. The c-spacing and the intensity of the diffraction lines also showed a break at the same temperature. At temperatures higher than 330°C, all the properties were found to agree with those of unreacted original graphite. The structure of Br–Gr residue compound and the nature of its change at high temperatures are discussed. (auth)

28292 CHOICE OF PYROCARBON DEPOSITION AGENT FOR NUCLEAR FUEL PARTICLES. Lefevre, R. L. R.; Praizey, J. P.; Price, M. S. T.; Thomas, J. P. (Organization for Economic Co-Operation and Development, Dorchester, Eng.). pp 139-140 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The majority of experience to date relating to pyrocarbon coatings on nuclear fuel particles, as used in the High Temperature Gas Cooled Reactor, is based on methane as the carbon source. Both economic and technical reasons suggest that this may not be the best choice. The properties of the derived pyrocarbons and the relative costs for different coating agents are briefly described. Although the evidence is not exhaustive, it is concluded that, provided the irradiation behavior is adequate and that the fission product retention can be entrusted to the silicon carbide layer, the use of propylene as deposition agent should be recommended. (auth)

28293 BUTANE AS A SOURCE OF PYROCARBON COATINGS FOR NUCLEAR FUEL PARTICLES. Voice, E. H.; Lamb, D. N. (Organization for Economic Co-Operation and Development, Dorchester, Eng.). pp 141-143 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Methane is the usual source gas for pyrolytically depositing strong dense impermeable pyrocarbon layers on nuclear fuel particles. Reactor experience is now showing up some limitations, particularly in the irradiation creep ductility at high neutron and fission-fragment doses. Hydrocarbons more complex than methane appear to form pyrocarbon essentially different in structure to that from methane, and these have improved radiation-damage resistance. This paper examines the use of butane, characterizing a wide range of physical and mechanical properties of the coatings relative to the formation conditions and deducing the microstructure and the pyrolytic reaction path. Butane in sufficiently pure form is widely and cheaply available and no practical difficulties have been found in its use. Reactor testing of realistic fuel particles using these coatings is now in progress to very high doses. (auth)

28294 INVESTIGATIONS ON PYROCARBON CANNING COATS BY MEANS OF PLASMA OXIDATION AND ULTRASONIC TEST.

Luhleich, H.; Buesch, H.; Hoven, H.; Suetterlin, L.; Wallura, E. (Kernforschungsanlage, Juelich, Ger.). pp 144-147 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Three methods are being dealt with (cold oxidation, wet oxidation, ultrasonic method), by which it is possible to learn new details of the structure of pyrocarbon canning coats of nuclear fuel particles. The results permit a derivation of a two-component model for the structure of isotropic pyrocarbon coats. (auth)

28295 BASAL PLANE THERMAL EXPANSION OF PYROCARBONS PRODUCED IN A FLUIDIZED BED AS COATINGS FOR HTGR FUEL PARTICLES. Pellegrini, G.; Vesentini, L.; Saracco, G.; Zubani, I. (Commission of the European Communities, Petten, Neterlands). pp 148-150 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The basal-plane thermal expansion of a series of well-characterized pyrocarbon structures deposited in a fluidized bed was investigated between 17 and 1100°C using the powder diffraction technique by means of a high-temperature Guinier Lenne camera. A surprisingly strong contraction of the basal planes is observed over a large range of temperatures, especially between 600 and 900°C. Residual gas analysis data show that a non-negligible amount of H_2 is released from the specimens during heating between 600 and 900°C. (auth)

28296 INVESTIGATIONS ON THE STRUCTURAL CHANGES IN NEUTRON-IRRADIATED OR HEAT-TREATED PYROLYTIC CARBON COATINGS OF COATED FUEL PARTICLES. Koizlik, K.; Balthesen, E.; Nickel, H.; Schuster, H. (Kernforschungsanlage, Juelich, Ger.). pp 151-154 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The change of the anisotropy of crystalline orientation in pyrolytic carbon coatings of fuel particles by heat treatment and neutron irradiation is measured by an optical method. The value of anisotropy increases by heat treatment as well as by neutron irradiation. The higher the temperature, the neutron fluence, or the burnup of the fuel kernel the higher is the amount of increase. The increase also depends on the starting values of the properties of the pyrocarbon. A qualitative model of the interpretation of the measured results is presented. (auth)

28297 INFLUENCE OF HEAT TREATMENT AND NEUTRON IRRADIATION ON THE MICROPOROSITY OF MATRIX MATERIAL AND GRAPHITE. Krautwasser, P.; Schulze, H. A.; Schuster, H.; Waechter, H. (Kernforschungsanlage, Juelich, Ger.). pp 158-161 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Small-angle x-ray scattering was used to study the microporosity of reactor graphite and matrix material. Parameters which were varied were composition of the material, heat treatment, and fluence of fast neutron irradiations. (auth)

28298 DIMENSIONAL CHANGES OF GRAPHITE AT HIGH FAST NEUTRON DOSES. Kelly, B. T.; Brocklehurst, J. E. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 172-175 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

It is well established that in well-crystallized graphites the dimensional changes under fast-neutron irradiation are controlled by the thermal expansion up to a critical dose and that this relation breaks down at high doses where a volume increase is established due to porosity generation. Samples of a basically isotropic graphite were irradiated at two temperatures at three different densities; one the standard material, a second lower-density version, and the third prepared by radiolytic oxidation of the first. It is found that the dimensional changes are independent of initial density at low doses, but the high dose reversal of shrinkage is delayed to higher doses the lower the initial density. The thermal expansion changes are similar in all of the materials. The results are analyzed in terms of the original Simmons theory of dimensional changes together with a generation of new porosity dependent upon internal strains. A qualitative analysis is given of the effects of density and radiolytic oxidation on dimensional changes. (auth)

28299 STRESS-STRAIN CHARACTERISTICS OF NONIRRADIATED AND IRRADIATED NUCLEAR GRAPHITES. Everett, M. R.; Ridealgh, F. (Organization for Economic Co-Operation and Development, Dorchester, Eng.). pp 191-193 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The tensile stress-strain and permanent set characteristics of Gilsocarbon graphite are investigated at room temperature and after constant-stress temperature-cycle conditions up to 1100°C. Results from post-irradiation examination of the mechanical properties of graphite irradiated in the Dragon Reactor at temperatures in the range 900 to 1200°C and fast neutron doses of up to 3×10^{21} n cm^{-2} Ni Dido are presented. The results indicate a nearly linear relationship between ultimate strength and Young's modulus rather than the usually accepted constant strain energy criterion. (auth)

28300 EFFECT OF TENSILE STRESS ON REACTION RATE AND RESIDUAL STRENGTH OF NUCLEAR GRAPHITES IN WATER VAPOR ATMOSPHERE. Krefeld, R.; Linkenheil, G.; Claude, P.; Karcher, W. (Commission of the European Communities, Petten, Netherlands). pp 216-218 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Tensile stress was applied to nuclear graphite specimens exposed to argon atmosphere containing 1000° vpm water vapor at 1000°C, and the effect of stress on the reaction $C + H_2O \rightarrow H_2 + CO$ was studied. A tensile stress of about 20 kg cm^{-2} produced an increase of the CO concentration by a factor of three, and a reduction of the ultimate tensile strength of about 10% compared to the unstressed conditions. It is believed that stress corrosion takes place as a result of high stress concentrations at the roots of graphite cracks. (auth)

28301 MEASUREMENT OF THE DIFFUSIVITY CONSTANT IN REACTOR GRAPHITE. Hardstaff, A. L.; Howard, A. N.; Law, P. W. (British Acheson Electrodes Ltd., Sheffield, Eng.). pp 220-222 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The advanced gas-cooled reactor relies on the diffusion of methane into the pore structure to inhibit the radiolytic corrosion of the moderator graphite. A description is given of the development of equipment to measure methane diffusivity on a routine basis in a production batch of moderator graphite. The paper includes an analysis of experimental error, reproducibility, and details of operating experience. Finally, a few results are presented. (auth)

28302 DIFFUSION EFFECTS IN GRAPHITE RADIOLYTICALLY OXIDISED IN $CH_4/CO/CO_2$ GAS MIXTURES. Jaquiss, M. T.; Lind, R.; Lewis, H. G. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 223-226 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Diffusion effects in graphite blocks exposed under irradiation to CO_2/CH_4 gas mixtures can lead to methane concentration gradients within the graphite. Two in-pile experiments were carried out to study this effect. In the first, the methane concentrations at the center of a block of graphite were measured and compared with theory. In the second, the corrosion profile caused by the varying methane concentration was determined directly. (auth)

28303 INTERACTION OF THERMAL AND RADIOLYTIC PROCESSES IN THE GASIFICATION OF GRAPHITE IN CO_2 MIXTURES. Linacre, J. K. (Atomic Energy Research Establishment, Harwell, Eng.); Keep, C. W.; Palmer, J. E. M.; Lind, R. pp 227-229 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

A laboratory-produced ^{14}C labeled analogue of an industrial reactor graphite was used to study the reactions of graphite with CO_2-based gas mixtures, under radiation, over the temperature range 350 to 750°C. At the lower temperatures in this range, radiolytic reactions provide the principal graphite gasification mechanism, but at the higher temperatures, thermal reactions predominate. Differences in reaction rate with gas composition are discussed. The low radiolytic reaction rate ($G \approx 0.1$) found in gas mixtures containing $CO/H_2O/CH_4$, at low temperatures, increase at high temperature as the protective effect of these additives is lost, and the rates approach the uninhibited value ($G \approx 3.0$) at about 800°C. The graphite became contaminated with nickel and iron and the effects of this, and of the graphite weight loss, on the reactions are considered. (auth)

28304 VAPOR DEPOSITION OF SILICON CARBIDE, PYROLYTIC CARBON, AND TANTALUM ON CARBON FIBRES. Fitzer, E.; Ignatowitz, E.; Sahebkar, M. (Univ., Karlsruhe, Ger.). pp 250-252 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The chemical vapor deposition of graphite fibers with stoichiometric silicon carbide, pyrolytic carbon, silicon carbide with excess carbon as well as metallic tantalum was investigated. The following deposition parameters have been studied systematically: residence time, temperature, and composition of the pyrolysis gas mixture. The tensile strength of the filaments coated with silicon carbide was diminished, while it was increased by a coating of pyrolytic carbon. However, it was retained constant by a coating of silicon carbide containing excess pyrolytic carbon. Coatings with metallic tantalum have also no effect on the tensile strength. The coated fibers were used in the preparation of composites whose properties were studied. (auth)

28305 BACON ANISOTROPY FACTOR OF PYROLYTIC GRAPHITE. Thrower, P. A. (Pennsylvania State Univ., University Park); Horton, W. S. pp 253-255 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Two functions proposed for the orientation parameter used in Bacon anisotropy factor determinations are investigated. It is shown that from the same data the two functions can give BAF values differing by several orders of magnitude. It is concluded that a reliable BAF value must be obtained using numerical integration and that limits in experimental accuracy must make the validity of values greater than 10 rather dubious. (auth)

28306 PROPERTIES OF PYROLYTIC CARBON: DEPENDENCE ON DEPOSITION TEMPERATURE AND CORRELATIONS. Marinkovic, S.; Tukovic, A.; Suznjevic, C.; Dezarov, I. (Boris Kidric Inst. of Nuclear Science, Belgrade). pp 259-265 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

An interpretation of observed dependence of pyrocarbon properties on deposition temperature (1220 to 1730°C) is attempted on the basis of following assumptions: (1) at medium temperatures (around 1500°C) the deposit is composed of subcrystalline matter together with developed carbon crystallites; towards higher or lower temperature there is less tendency for the amorphous material formation; and (2) there are interconnections between crystallites in the pyrocarbon. (auth)

28307 INTERNAL DEFECTS AND THE STRENGTH OF CARBON FIBRES. Sharp, J. V.; Burnay, S. G. (Atomic Energy Research Establishment, Harwell, Eng.). pp 310-312 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

High-voltage electron microscopy techniques have been used to examine internal defects in a wide range of carbon fibers. Typical defects in graphitized fiber are described. Large crystallites inclined at relatively large angles to the fiber axis are frequently observed associated with the elongated bubble-type defects. Failure is believed to occur at these flaws because of the large shear strains produced in these crystallites when the fiber is under a tensile stress. The distribution of internal defects of all diameters is observed to be approximately uniform across the fiber cross section. This indicates that if a core/sheath effect exists in fibers, preferential failure in the core region is only likely to occur due to differences in modulus between the two regions. (auth)

28308 MOLDING OF CARBON PARTS BY AN ISOSTATIC PROCESS. Bigot, R.; Foure, J. (Societe le Carbone Lorraine, Paris). pp 384-387 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In French).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

A vessel diameter 1000 × 2500 mm was used to mold isotropic artificial graphite parts diameter 400 × 900 mm and diameter 520 × 620 mm max. The isostatic compression process allows parts of any shape to be molded with a minimum tooling delay. The various fine-grained Le Carbone-Lorraine grades obtained by isostatic compression have excellent isotropic characteristics which do not depend on dimensions. (auth)

28309 ANISOTROPY OF MOLDED SPECIMENS AS A FUNCTION OF THE COKE MATERIAL AND THE PRODUCTION PROCESS. Rosswurm, H.; Pietzka, G.; Ulsamer, W. (Sigri Elektrographit GmbH, Frankfurt am Main). pp 403-405 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

An extruded isotropic graphite to be used in a reactor was developed. It is produced in a special procedure from a very anisotropic needle coke which can be well graphitized. The procedure is as follows: The pulverized needle coke is mixed with pitch and is subsequently coked, with this secondary product, in which the particles of the needle coke are supposed to be statistically distributed in all spatial directions of the pitch-coke matrix, then being ground into grains and powders. The smallest powder particles of the secondary product have to be three times larger than the initial needle coke particles. The molded specimens thus obtained are specimens with a very low anisotropy coefficient for the thermal expansion and electrical resistance; they are comparable to those made e.g., from gilsonite coke, however with a lower electrical resistivity and with lower thermal expansion coefficients. (auth)

28310 APPLICATION OF MERCURY POROSIMETRY TO GRAPHITIC MATERIALS. Haag, G. (Kernforschungsanlage, Juelich, Ger.). pp 420-422 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972). International carbon conference.

After a short introduction to mercury porosimetry, the problems of its application to graphitic materials are discussed. In this case the influence of "ink-bottle-pores" and the damage which occurs to the materials at higher pressures have great importance. With regard to these problems "penetration diagrams" of different materials are presented and interpreted. Some of these materials have been irradiated with fast neutrons; it is well known that under convenient irradiation conditions, the porosity as well as pore size distribution are strongly changed. (auth)

28311 GRAPHITE MATRIX DEVELOPMENT FOR HTR FUEL ELEMENTS. Becker, H. J.; Herrmann, F. J.; Huschka, H.; Hrovat, M.; Venet, P. (Nuklear-Chemie und -Metallurgie GmbH, Wolfgang, Ger.). vp of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international meeting on carbon; Baden-Baden, Ger. (25 Jun 1972).

Graphite matrix for HTR fuel elements is based on natural graphite and artificial graphite as filler and a phenolic resin as binder. The measurement of the density of artificial powder under compression is used to determine its temperature of graphitization. An optimal matrix composition is found with 80% natural graphite. At this composition mechanical properties are improved to about 50% by decreasing filler grain size and by increasing binder condensation. Mechanical strength and thermal conductivity of the matrix are considerably influenced by small differences in the degree of graphitization of artificial powder. The maximum temperature attained during the final heat treatment is decisive for the purity, BET-surface, corrosion behavior, and mechanical properties of the matrix. (auth)

28312 CHANGES OF THE DIMENSIONS AND OF THE PHYSICAL PROPERTIES OF GRAPHITE AND OF GRAPHITIC MATRIX MATERIAL DURING NEUTRON IRRADIATION AT VARYING TEMPERATURES. Delle, W.; Ragoss, H. (Kernforschungsanlage, Juelich, Ger.). vp of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international meeting on carbon; Baden-Baden, Ger. (25 Jun 1972).

During the irradiation of graphite or graphitic matrix material at varying temperatures, the change of dimensions and physical properties as a function of the fluence will be subject to the various temperatures applied. It is of special importance in this process whether the graphite did already reach the turn-around, i.e., the stage of maximum shrinking, or not. At the change of temperatures from below 900°C to higher temperatures, shrinking will be increased before the turn-around. Beyond this region, heavy swelling has been found when initial temperatures amounted to 650°C or even less. A change of temperature from between 700 and 850°C to temperatures above 900°C will shift the turn-around to higher fluences. In solid bodies with temperature gradients between the core of the body and its surface, internal strains due to irregular shrinkage will be reduced by irradiation-induced creep to such an extent that no damage can be found on the surface. Repeated cycling, even with varying fluences, from a surface temperature to higher or lower temperatures will not cause any damage on the outside. The change of physical properties is heavily influenced by temperature variations. An increase in the temperature will especially improve the thermal conductivity. The elas-

ticity modulus will be lowered at rising temperatures and increased in the inverse process. Within the range of fluences hitherto obtained in the cycling experiments, the values measured for the elasticity modulus have in every case been found to be above the pre-irradiation values, which indicates that cycling will have no reducing effect on the strength of the graphite material. (auth)

28313 IRRADIATION INDUCED CHANGES OF THERMAL EXPANSION (C.T.E.) OF NUCLEAR GRAPHITES. Delle, W. (Kernforschungsanlage, Juelich, Ger.). vp of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international meeting on carbon; Baden-Baden, Ger. (25 Jun 1972).

The coefficient of linear thermal expansion (C.T.E.) increases at low fluences up to about 30%. At irradiation temperatures below 600°C it stays, with increasing fluence, higher than before irradiation. At higher temperatures, thermal expansion decreases with increasing fluence up to 80% below the initial value. The C.T.E. increase can be explained by the lacking possibilities of buffering by closing of microcracks. The following decrease is possible when new space for buffering of the crystallite expansion in "c" direction is available, owing to void clustering and migration. The decrease of C.T.E. is crystallite size dependent: The smaller the crystallites the greater the fractional decrease. Graphites with high crystallinity (natural flake, needle coke) do not show the decrease above. (auth)

28314 OPTICAL DETERMINATION OF THE ANISOTROPY OF PYROCARBON. Koss, P.; Wallisch, K. (Oesterreichische Studiengesellschaft fuer Atomenergie GmbH, Siebersdorf, Austria). vp of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In German).

From international meeting on carbon; Baden-Baden, Ger. (25 Jun 1972).

The irradiation behavior of pyrocarbon-coated fuel particles is critically dependent on the anisotropy of the coating. A method for determining the anisotropy, based on the optical anisotropy of graphite single crystals, is described. The ratio of the reflectivities of a pyrocarbon section for polarized light with the E-vector parallel and perpendicular to the direction of preferred orientation is defined as the optical anisotropy factor. Anisotropy profiles across the coating as well as irregularities can be determined by this technique. The theoretical and experimental basis and a fully automatic measuring equipment are described together with the results obtained. (auth)

28315 PHYSICAL AND MECHANICAL PROPERTIES OF NUCLEAR GRAPHITES. Their Application in High Temperature Reactors. Mottet, P. (CEN de Saclay, Gif-sur Yvette, France); Rappeneau, J.; Lore, J.; Cornuault, P. vp of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972). (In French)

From international meeting on carbon; Baden-Baden, Ger. (25 Jun 1972).

Different kinds of graphite have been elaborated in order to correspond with the criteria established for their use as fuel element tubes or as moderator blocks in High Temperature Reactors. Among these different kinds of graphite, four have been selected and produced on an industrial scale. The physical, mechanical, and thermal properties of these materials are described and their texture is examined. The results show that these graphites, when unirradiated, correspond with the considered operating conditions in HTR. In order to know the irradiation behavior of these materials, experiments have been made in the RAPSODIE, SILOE, OSIRIS, and DRAGON reactors. Although all irradiation experiments are not finished, first results show that the irradiation behavior of these materials can be considered as satisfactory. Finally, properties of some new products recently elaborated are given, whose use in HTR might be very promising. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

28316 STATISTICAL TERMINOLOGY AND NOTATION FOR NUCLEAR MATERIALS MANAGEMENT. ANSI N15.5-1972. New York; American National Standard Institute (1972). 8p.

This standard deals with terminology and notation normally used in the statistical analyses of accountability data for nuclear materials management. One purpose of this standard is to define terminology used in the control of nuclear materials. The standard primarily emphasizes words and expressions which, on the one hand, are frequently encountered and, on the other hand, may have different meanings to different individuals. No attempt is made to compile a complete glossary of statistical terms. A second purpose of the standard is to define a few general rules on notation to permit easier communication. It is not the intent of the standard to be rigid in this respect and, in many instances, it may be necessary for practitioners to introduce notation specific to the management of nuclear materials. It is emphasized that this standard is written for practitioners in the field of nuclear materials management. Consequently, the choice has been made to promote understanding in application at the occasional expense of mathematical rigor. Specifically, because it is recognized that in practice, all data and the corresponding populations are discrete and, at most, countably infinite due to limitations in measurement, emphasis is given to the type of data which would promote understanding in application. This avoids certain problems which would otherwise be encountered when attempting to generalize the various definitions. (auth)

Disposal and Storage

Refer also to abstracts 27574 and 27576.

28317 MEDIUM-TERM STORAGE OF CONDITIONED RADIOACTIVE SOLID WASTES AT C.A.M.E.N. (ITALY). Argiero, L.; Lo Moro, A.; Marchi, S.; Panciatic, G. (CAMEN, Pisa, Italy). Energ. Nucl. (Milan); 20: No. 3, 177-180(Mar 1973). (In Italian).

The medium term storage of radioactive solid wastes is described. The facility was constructed and operated by C.A.M.E.N. (Centro Applicazioni Militari Energia Nucleare), located at S. Piero a Grado (Pisa, Italy). Wastes are incorporated in cylindrical concrete standard containers and stored on a concrete open-air bed. (auth)

Handling Equipment and Procedures

Refer also to abstract 27924.

28318 APPARATUS FOR HANDLING URANIUM HEXAFLUORIDE. Tillessen, U.; Pirk, H. (to Nuklear-Chemie und Metallurgie GmbH). Canadian Patent 909,403. 5 Sep 1972. Priority date 14 May 1969, Federal Republic of Germany (F.R. Germany).

An apparatus for handling uranium hexafluoride consists of an inner, removable tank containing UF_6 and an outer jacketing pressure vessel. The inner tank can be sprayed with water or steam to melt or vaporize its contents, so that liquid or gasoues UF_6 can be withdrawn through a narrow-gauge pipe, under pressure. If there is a leak, it is contained within the outer vessel. (CA)

28319 SEALED RADIOACTIVE SOURCES FOR REMOTE CONTROL GAMMA THERAPY. Rayonnements Ionis. Tech. Mes. Prot.; No. 4, 50-53(Oct 1972). (In French).

A government decree concerning the authorization of the charging and recharging of remotely handled gamma therapy apparatus and the retention and utilization of radioactive sources for this purpose is presented. (FR)

28320 PROCEEDINGS OF THE 20TH CONFERENCE ON REMOTE SYSTEMS TECHNOLOGY, IDAHO FALLS, IDAHO, SEPTEMBER 19-21, 1972. Farmakes, R. (ed.). Hinsdale, IL; American Nuclear Society, Incorporated (1972). 358p. (CONF-720903-).

Forty-two papers were presented at the conference. A separate abstract was prepared for each of 27 papers. The remaining 15 papers have been previously abstracted for NSA. For abstracts of the papers see CONF-720903 in the Report Number Index. (RCK)

For abstracts of individual papers see: 28321-28343, 29497, and 29504-29506.

28321 DEVELOPMENT OF ON-SITE REACTOR FUEL EXAMINATION CAPABILITY. McClintock, D. R.; Vizzini, T. A. (Westinghouse Electric Corp., Pittsburgh). Conf. Remote Syst. Technol., Proc.; 20: 3-13(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

An integrated Mobile Fuel Evaluation System (MFES) was developed to permit the verification of operating plant fuel performance and to facilitate the evaluation of advanced fuel concepts. This portable system contains visual, dimensional, and radioactivity measuring equipment, cutting and handling equipment, and auxiliary support equipment for transportation and maintenance. Extensive use is made of remote TV and remote profilometry for physical measurements, in addition to equipment for remote disassembly (cutting) of fuel elements up to 12 ft long is included. The MFES has been successfully employed in a series of irradiated fuel examinations at six commercial reactor sites. (auth)

28322 PRE-STARTUP ACTIVITIES AT THE MIDWEST FUEL RECOVERY PLANT. Eschen, V. G.; Herrington, C. C. (General Electric Co., Morris, IL). Conf. Remote Syst. Technol., Proc.; 20: 55-60(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The experience gained in the training and testing of the MFRP prior to licensing is given. The point is made that the startup of a nuclear fuel reprocessing facility is significantly different from a conventional chemical plant and requires personnel staffing when the plant is 30% completed. (auth)

28323 EXPLOSIVE WELDING IN A HOT CELL. Martin, R. L. (Battelle Columbus Labs., OH); May, R. F. Conf. Remote Syst. Technol., Proc.; 20: 73-77(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

Based on research at Battelle-Columbus, explosive welding was used to repair a stainless-steel pipeline inside a hot cell. No damage was done by the explosive to adjacent pipes or any other equipment in the cell. The expanding gases did not produce an overpressurization in the cell, so the negative pressure was never lost. The absolute filters were not damaged as a result of the explosion and there was no spread of radioactive materials outside the cells. (auth)

28324 DESIGN OF A REMOTE SODIUM-REMOVAL SYSTEM. Wilber, W. W. (Aerojet Manufacturing Co., Fullerton, CA). Conf. Remote Syst. Technol., Proc.: 20: 154-159(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

Disassembly and examination of tests and fuel assemblies in the Interim Examination/Maintenance (IEM) Cell at the FFTF is made more effective by inclusion of a sodium-removal system in the cell. This system will react and remove sodium from fuel assemblies or tests generating up to 7 kW of decay heat. It will also be used to clean fuel handling machine grapples. The design provides for retention of all moisture, both liquid and vapor, within the sodium-removal system. All components will be dried prior to removal from the system. (auth)

28325 PRECISION GAMMA SCANNING AT THE HOT FUEL EXAMINATION FACILITY. Rizzie, J. W.; Adkins, H. E.; Just, F. H.; Adam, M. F. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 175-189(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

Argonne National Laboratory's Hot Fuel Examination Facility (HFEF) is using a fully automated Precision Gamma Scanner (PGS) for postirradiation interim examination of experiment in the EBR-II reactor. The PGS operates in four scanning modes: axial, diametrical, and radial gamma scanning; and capsule or element failure detection. The PGS has become a very sensitive hot-cell examination device for the detection of micro- and macrocladding failures in fuel elements both encapsulated and unencapsulated. Full automation of the PGS allows the device to operate 24 h a day without operator attention, making it possible to collect vast amounts of data with increased experiment throughput. Computer services are available for reduction of the gamma spectra to isotope distribution plots and listings for the irradiation experiments, thus providing useful data for the sponsors of these experiments. (auth)

28326 MULTIPURPOSE COMPUTER-CONTROLLABLE POSITIONING STAGE FOR THE HOT FUEL EXAMINATION FACILITY. White, J. R.; Hutton, J. E.; Walker, K. L. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 190-196(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

A prototype positioning stage has been designed and fabricated for use in the Hot Fuel Examination Facility (HFEF) at the NRTS, Idaho. The stage is expected to have multiple applications in the wide variety of operations and examinations on reactor elements, subassemblies, and loop components that are scheduled for the HFEF complex. These operations include gamma scanning, profilometry, stereomacroscopy, eddy-current scanning, disassembly, and reassembly. Precision positioning in the X, Y, and Z directions is achieved with precision ball screws and stepping motors. Absolute encoders can be installed on all motions for closed-loop computer-controlled operation. Modular construction has been employed on both the mechanical hardware and electrical-control system for ease of maintenance and for versatility of usage. (auth)

28327 OPTICAL PROFILOMETER SYSTEM FOR IN-CELL MEASUREMENT OF IRRADIATED CAPSULES AND ELEMENTS. Adam, M. F.; Bacca, J. P.; White, J. R. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 197-202(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The increased demands for remote profilometry of irradiated elements at the Hot Fuel Examination Facilty, NRTS, Idaho, have resulted in the development of a new optical profilometer system. The system utilizes an out-of-cell electro-optical gaging device that is capable of measuring diameters from 0.174 to 0.805 in. with an accuracy of ±100 μin. A shielded and gastight optical relay is installed in the cell wall for measuring elements within an argon-atmosphere, alpha-contaminated environment. Elements up to 96 in. long with external spacer wires and a variety of end fittings can be handled by the in-cell element-positioning stage. (auth)

28328 REMOTE-METALLOGRAPHY FACILITY IN THE HOT FUEL EXAMINATION FACILITY. Natesh, R.; Bacca, J. P.; Brak, S. B.; Taylor, D. S.; White, J. R. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 203-212(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

A unique metallography facility has been provided for remotely preparing and examining metallographic samples from high-burnup fuel elements in the Hot Fuel Examination Facility. The facility equipment includes an in-cell containment box for sample preparation and an out-of-cell shielded loading box for microexamination and replication. The samples are rapidly transferred between boxes by a gastight pneumatic tube. The samples are maintained in a high-purity argon atmosphere throughout the metallographic operations. (auth)

28329 REPAIR FEATURES OF THE HOT FUEL EXAMINATION FACILITY-NORTH REMOTE HANDLING SYSTEM. Graae, J. E. A.; Jamrog, A. R.; Mingesz, D. P. (Argonne National Lab., IL). Conf. Remote Syst. Technol., Proc.; 20: 213-221(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The remote handling system for the Hot Fuel Examination Facility-North incorporates several features that aid repairs. Because of these, all handling equipment in the main cell can be repaired without personnel access to the cell. With a special hoist installed on the main cell roof, operators can remove crane and manipulator bridges from their rails and lower them to the cell floor. Once at the floor level, modular subassemblies — such as the bridge wheel units — can be remotely removed, transferred to another area for repairs by personnel in tunnel suits, and then remotely reinstalled. (auth)

28330 CELL ELECTRICAL DISTRIBUTION SYSTEM FOR THE HOT FUEL EXAMINATION FACILITY-NORTH. Marbach, R. A.; Mingesz, D. P. (Argonne National Lab., IL). Conf. Remote Syst. Technol., Proc.; 20: 222-226(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The electrical distribution system for the HFEF/N hot cells incorporates several innovations designed to facilitate cell operations, future expansion, and repairs. Each work station in the facility is equipped with a modular array of power and control circuits terminated in conventionally located in-cell and out-cell receptacles. Similar instrumentation circuits are installed at selected work stations. All in-cell receptacles are within easy reach of the master-slave manipulators used to connect equipment to the system. A new type of flexible wire used in-cell is serviceable after exposure to 2.3×10^9 R. The in-cell components of the electrical system are all replaceable without having personnel enter the cells. (auth)

28331 CELL LIGHTING FOR THE HOT FUEL EXAMINATION FACILITY-NORTH. Marbach, R. A.; Mingesz, D. P. (Argonne National Lab., IL). Conf. Remote Syst. Technol., Proc.; 20: 227-231(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The cell lighting system installed in the Hot Fuel Examination Facility-North (HFEF/N) is the result of a concerted effort to provide high-quality illumination of each cell work station. A modular design approach was used throughout to facilitate design and maintenance, and to minimize the total cost of the system. All in-cell components are remotely replaceable. The system was designed to achieve an in-cell illumination level at each work station of over 600 fc, and requires a 3.2 kW per station. Considering the illumination provided, this heat load is considerably less than that achieved by earlier hot cell lighting systems. (auth)

28332 MULTIPURPOSE PROCESSING FACILITY TO SEPARATE ACTINIDES. Kelsch, R. D.; Lethco, A. J.; Mellen, J. B. (E. I. du Pont de Nemours and Co., Aiken, SC). Contract AT (07-2)-1. Conf. Remote Syst. Technol., Proc.; 20: 235-248(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

A portion of the hot canyon in a radiochemical separations building was converted from a remote-crane-operated facility to a master-slave manipulator-operated facility for the large-scale separation and purification of radionuclides by ion exchange. Process and service equipment is of a remotely replaceable modular type, and service systems can be remotely replaced without disturbing process equipment. Systems are provided for removing products and solid waste in clean containers without spreading contamination. Initial process equipment installed in the facility allows separation of ^{252}Cf from other transplutonium isotopes. Up to 260 mg of ^{252}Cf can be handled at each operating position. A unique on-line monitoring system controls the ion exchange process. (auth)

28333 CONSTRUCTION OF HOT CELLS FOR PROCESSING CALIFORNIUM-252. Scotti, V. G.; Martin, R. L. (Battelle Columbus Labs., OH). Conf. Remote Syst. Technol., Proc.; 20: 253-255(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

Two alpha-gamma hot cells at Battelle-Columbus have been converted to handle ^{252}Cf. Up to 10 mg of ^{252}Cf can be handled in these hot cells. The conversion involved the addition of neutron shielding so that bulk ^{252}Cf may be chemically processed and encapsulated. (auth)

28334 HIGH-TEMPERATURE SODIUM FACILITY. Gray, D. (Westinghouse Hanford Co., Richland, WA). Conf. Remote Syst. Technol., Proc.; 20: 256-260(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The High-Temperature Sodium Facility is being constructed at the Hanford complex near Richland, Washington, in support of the Fast Flux Test Facility development and testing within the LMFBR Program. The facility contains test beds for fuel element mechanical development, core restraint systems, fuel handling equipment, tests of engineered equipment, and ancillary equipment necessary for testing. A 39,000-gal sodium test vessel is provided with 1100°F, 500-gpm flow capability. A prototype FFTF closed-loop test system consisting of a 2.3-MW heater in the primary system coupled with a secondary heat dump system is also provided. Total sodium inventory is 50,000 gal. (auth)

28335 INSTALLATION OF PENETRATION LINERS IN AN ARGON ATMOSPHERE CELL. Taylor, D. S.; Carnes, M. D.; Paige, D. M.; Hagmann, D. B. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 261-267 (1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

Ten penetration liners were installed in the HFEF/S argon cell for master-slave manipulators and periscopes. The installation required core drilling 14- and 16-in.-dia holes through 60 in. of high-density concrete and a $\frac{3}{8}$-in.-thick steel liner plate. Steel liners were inserted into the core-drilled holes and sealed to the cell liner with a resilient gasket. The entire installation was accomplished without entry of personnel into the contaminated cell, loss of cell argon atmosphere, or release of contaminants to out-of-cell areas. (auth)

28336 BATTELLE-COLUMBUS HOT CELL AND POOL FOR EXAMINATION OF ENTIRE FUEL ASSEMBLIES. Martin, R. L.; Scotti, V. G. (Battelle Columbus Labs., OH). Conf. Remote Syst. Technol., Proc.; 20: 268-270(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

An addition made to the Battelle-Columbus Hot Lab Facility has the capability to perform comprehensive postirradiation examinations or power reactor fuel assemblies even larger than those now contemplated. The new hot cell has internal dimensions of 9 ft deep × 25 ft high × 38 ft long. A 20- × 20- × 45-ft-deep pool is connected to the cell by means of a transfer canal. By means of this unique arrangement, both nondestructive and destructive examinations can be performed on entire fuel assemblies. (auth)

28337 DEVELOPMENT OF THE REMOTE HANDLING FACILITIES AT BERKELEY NUCLEAR LABORATORIES. Hines, G. F.; Haddrell, V. J.; Stagg, M. S. (Central Electricity Generating Board, Berkeley, Eng.). Conf. Remote Syst. Technol., Proc.; 20: 271-279(1972).

From 20th remote systems technology conference, Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

Cave, cell equipment, and working methods evolved during 12 years of examination of irradiated fuel elements at Berekley Nuclear Laboratories of the Central Electricity Generating Board are described. When the original cave line was commissioned in 1961 it was equipped with standard machine tools modified for remote use and operated by "through-the-wall" control shafts. During subsequent use, the limitations of this approach became apparent and machines for the new cave lines were designed to be freestanding and remotely removable. The rate of working in the caves and cells was further improved by the development of better viewing, specimen transfer, and waste disposal systems. An important advance has been the use of prefabricated steel sections for cell shielding since these are much easier to erect than conventional lead brick walls. Comments are made on the advantages that the CEGB, as a power generating utility, derives from possession of its own facilities for the examination of highly active components. (auth)

28338 MA22: A COMPACT BILATERAL SERVO MASTER-SLAVE MANIPULATOR. Flatau, C. R. (Teleoperator Systems, Shoreham, NY); Vertut, J.; Guilbaud, J. P.; Germond, J. C.; Glachet, C. Conf. Remote Syst. Technol., Proc.; 20: 296-302 (1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

The development of MA22 was originated to satisfy the requirements of the "Virgule" remote vehicle which constrained development in the direction of a light and small device. Optimization of mass distribution and the use of classical tape and cable transmission results in a self-balancing configuration in which four of the motor actuators are so placed in the counterweight mass that exact balancing is achieved. The other three motors are in a fixed assembly which drives the shoulder and elbow motions via a three-way differential. The use of this differential drive results in minimized inertia and improved capacity-to-inertia ratio. The low-inertia dc servo motors are driven by an amplifier driver system in the position-position mode. This yields a completely symmetrical driving scheme which is fully bilateral, stable, and easily interfaced into a digital communication link. (auth)

28339 VIRGULE VARIABLE-GEOMETRY WHEELED TELE-OPERATOR. Vertut, J.; Guilbaud, J. P.; Debrie, G.; Germond, J. C.; Riche, F. (CEA, Saclay, France). Conf. Remote Syst. Technol., Proc.; 20: 303-309(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720930–.

VIRGULE is a French acronym referring to a radio-controlled rescue vehicle capable of operating over rough terrain either indoors or outdoors. The teleoperator is equipped with at least two TV camaras and one pair of MA22 master-slave manipulators, each capable of exerting 12-kg forces in any direction, and of lifting up to 30 kg in certain positions. The four-wheeled vehicle has more flexibility than a track vehicle: It can move in a straight line in any direction (referred to its own axis) and can steer about any center of rotation, controlled by a single control handle with three degrees-of-freedom. When the vehicle is moving, only one arm can be operated. A 24-channel digital communications link is used for control, and another one for feedback. These links may be radio or coaxial cable. Batteries provide short-term autonomous operation; power mains (indoors) or a gasoline-engine-driven generator (outdoors) are used for long operation. (auth)

28340 SYSTEM APPROACH TO LOW-BUDGET REMOTE HANDLING TECHNIQUES IN LARGE CIRCULAR ACCELERATORS. Flatau, C. R. (Brookhaven National Lab., Upton, NY). Conf. Remote Syst. Technol., Proc.; 20: 318-327(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

A number of large accelerator installations are faced with residual activity problems at a time of budgetary constraints. A system is evolved which aids in designing low-budget remote maintenance capability for certain high activity accelerator installations. This procedure was employed successfully in the design of a recent system of the Brookhaven AGS. (auth)

28341 DEVELOPMENT OF ANCILLARY EQUIPMENT FOR USE IN HOT CELL FACILITIES. Montgomery, C. D.; Chavez, M. G.; Jones, H. E.; Lazarus, M. E. (Los Alamos Scientific Lab., NM). Conf. Remote Syst. Technol., Proc.; 20: 331-332 (1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

The following pieces of auxiliary equipment for use in hot cell facilities are briefly described: a heavy-duty cart for transporting casks of radioactive materials within an unloading area; an electromechanical elevator of 200 lb capacity for remote loading and unloading of the contents of a large 22-ton fuel element shipping cask; and a precision collimator for gamma scanning systems. (LCL)

28342 WALL-PERISCOPE VIEWING SYSTEM. Iverson, G. M. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 333-334(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

A wall-periscope viewing system for the Hot Fuel Examination Facility using the Kollmorgen Model 301 periscope inserted through a double-sealed lined wall opening is described. (LCL)

28343 POWER-ASSIST MANIPULATOR-GRIP ACCESSORY. Adam, M. F. (Argonne National Lab., Idaho Falls, ID). Conf. Remote Syst. Technol., Proc.; 20: 335(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903–.

A small power-assist accessory developed for use with the in-cell tong assemblies of master-slave manipulators is described. It is lightweight, can be fitted to existing manipulators, and provides a controlled, positive, self-locking squeeze directly to the jaws of the tong assembly. When not actuated, the normal operation of the tong assembly is not compromised in dexterity or feel. (LCL)

Transportation

Refer also to abstract 29809.

28344 (EURISOTOP–55(Vol. 2), pp 1141-1148) TECHNOLOGICAL AND DESIGN-RELATED PROBLEMS INHERENT IN SEALING SPECIALLY DIMENSIONED ISOTOPE TRANSPORTATION CONTAINERS WITH LEAD. Pape, G. (Bleiindustrie KG, Hamburg). 1972. (In German).

From Conference on radiation and isotope techniques in civil engineering; Brussels, Belgium (28 Oct 1970).

A newly developed method for sealing isotope transportation containers with lead is described with reference to a container used for the on-site carriage of irradiated capsules at the Geesthacht/Elbe Reactor Establishment. (auth)

28345 PACKAGING OF URANIUM HEXAFLUORIDE FOR TRANSPORT. ANSI N14.1-1971. New York; American National Standards Institute (1971). 44p.

Guidance and criteria for the safe and economical shipment of uranium hexafluoride (UF_6) are presented in this standard. It will assist in providing for campatibility of UF_6 packaging among different users within the nuclear industry. The standard provides criteria for packaging of UF_6 for transport. It includes specific information on design, fabrication, inspection, cleanliness, and in-service requirements for the UF_6 packaging. Also included are cylinder loadings, shipping details, and requirements for valves and valve protectors. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 29003 and 29376.

28346 (CONF-730310-11) DEVELOPMENT AND OPERATING OF A PROTOTYPE SUPERCONDUCTING LINAC FOR HEAVY-ION ACCELERATION. Aron, J.; Benaroya, R.; Bollinger, L. M.; Gray, K. E.; Jaffey, A. H.; Lynch, F. J.; Johnson, K. W.; Khoe, T. K.; Livingood, J. J.; Nixon, J. M.; Parker, G. W.; Ramler, W. J.; Wesolowski, W. A. (Argonne National Lab., Ill.). 1973. 14p. Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

A prototype superconducting-helix accelerator is described and design considerations are discussed. The results obtained during 120 h of beam acceleration are given. These include a wealth of practical engineering experience, the demonstration of stable operation with external phase control, and measurements of various kinds of accelerator-physics data. (auth)

28347 (CONF-730310-13) VIBRATION-RF CONTROL OF SUPERCONDUCTING-HELIX RESONATORS FOR HEAVY-ION ACCELERATION. Despe, O. D.; Johnson, K. W.; Khoe, T. K. (Argonne National Lab., Ill.). 1972. 12p. Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

An electronic system for the control of the effects of rf frequency oscillations caused by mechanical vibrations in a superconducting helix is described. A combination of frequency modulation and amplitude modulation is used to lock the phase of a self-excited accelerating structure to that of a controlling master oscillator. The system has been used successfully during beam acceleration with a superconducting helix. (auth)

28348 (IFVE-INZ-72-17) START-UP OF LINEAR ACCELERATOR WITH rf QUADRUPOLE FOCUSING. Il'evskii, S. A.; Kapchinskii, I. M.; Kuznetsov, G. F.; Mal'tsev, A. P.; Mirzoev, K. G.; Nizhegorodtsev, V. V.; Stepanov, V. B.; Teplyakov, V. A.; Kholodenko, M. A.; Shalashov, I. M. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1972. 11p. (In Russian). INIS.

Initial experiments were conducted on sections of a proton linear accelerator with focusing by means of a high-frequency quadrupole field. A proton beam was obtained at the discharge port with an energy of 3.3 MeV and a current of 25 mA. (tr-auth)

28349 3 MEV VAN DE GRAAFF OF THE TEHERAN NUCLEAR CENTER. Farrokhi, S. (Teheran Univ. Nuclear Centre, Iran); Moghemi, D.; Nahavande, R.; Pichevar, M.; Delaunay, B. Bull. Inform. Sci. Tech. (Paris); No. 172, 65-70(Jul 1972). (In French).

A 3 MeV horizontal Van de Graaff accelerator has been installed at the Teheran Nuclear Center. A 3 MeV, 400 μA hydrogen beam, a 3 MeV, 50 μA proton beam, and a 3 MeV, 100 μA electron beam have been obtained. The operating conditions for these different beams are described. (FR)

28350 ACCELERATION OF ALPHA PARTICLES BY THE SPACE RADIATION EFFECTS LABORATORY SYNCHRO-CYCLOTRON. Suzuki, A.; Hansen, C. F.; Siegel, R. T. (Space Radiation Effects Lab., Newport News, VA). Nucl. Instrum. Methods; 108: No. 1, 177-187(1973).

A modification of the SREL synchrocyclotron has been completed, allowing acceleration of alpha particles ($^4_2He^{++}$) as well as protons. The main parts of the modification are in the rf system and the ion source. No changes in the main magnet, extraction channel or beam transport system have been required. The energy of extracted protons from the SREL synchrocyclotron is 588 MeV and the corresponding energy of alpha particles is 707 MeV. At the time of the initial testing, the beam intensity was found to be over 0.2 μA (6×10^{11} alphas per second) near the extraction radius, and 0.3 μA at the radius of 28'' (86 MeV). The modified cyclotron operates reliably in both the proton and alpha-particle modes, with a period of about eight hours required for the changeover between modes. (auth)

28351 NEW COMPACT CYCLOTRON: ENGINEERING-PHYSICS CONSTRUCTION. Hartwig, E. Nucl.-Med., Suppl.; No. 9 Suppl., 320-326(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992--.

The development of a new compact cyclotron by AEG is described. Specifications are listed. The instrument will have various attachments for special medical purposes. It will be installed in the Institute for Nuclear Medicine of the German Cancer Research Center at Heidelberg. Requirements of space and personnel are discussed as well as routine operation of the apparatus. (HBG)

28352 NEW COMPACT CYCLOTRON. Medical Applications. Roeding, P. C. Nucl.-Med., Suppl.; No. 9 Suppl., 327-330(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992--.

The advantages of a compact cyclotron for isotope and neutron production are outlined. In its medical application, the apparatus must be highly flexible. This flexibility should permit various modes of operation: the local production of numerous isotopes, especially those with short half-lives; and therapeutic radiations that are adjustable to special clinical problems. (tr-auth)

28353 DEVELOPMENT OF A COMPACT CYCLOTRON AND EXPERIENCE IN MEDICALLY INTERESTING USE FIELDS. van Kranenburg, A. A. (Philips Research Labs., Eidenhoven, Netherlands). Nucl.-Med., Suppl.; No. 9 Suppl., 331-339(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurich, Switzerland (25 Sep 1969).

See CONF-690992--.

A compact cyclotron was developed in the Philips Research Laboratory. A prototype is already in operation. During development and construction, experiments within the application field of the compact type were performed with an isochron-variable-energy cyclotron. These studies were aimed at activation analysis, production of short-lived isotopes, and neutron production. Based on the practical and theoretical experience with the prototype, the final design of the compact cyclotron will include a variable energy machine with a somewhat higher particle energy. (tr-auth)

28354 MODEL STUDIES OF A HALF GeV CYCLOTRON. Jain, A.; Divatia, A. S. (Bhabha Atomic Research Centre, Bombay). pp 473-477 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28355 CYCLOTRON PROJECT OF THE NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES. Hashizume, T.; Umegaki, Y. (National Inst. of Radiological Sciences, Chiba, Japan). Proc. Jap. Conf. Radioisotop.; No. 10, 483-485(Apr 1972). (In Japanese).

From tenth conference on radioisotopes; Tokyo, Japan (16 Nov 1971).

In the National Institute of Radiological Sciences, construction of a medical cyclotron for the fast-neutron treatment of malignant tumors was planned. In this cyclotron, the average neutron energy is expected to be more than 15 MeV, and the proton energy 60 MeV. In addition, this cyclotron can accelerate heavy protons, 3 H, and alpha particles. In the establishment of the cyclotron, it is expected that physical and radiological studies on accelerated particles will be carried out, and the treatment by neutrons and protons and production of radioisotopes and medical use of those produced will be performed. This cyclotron has a high particle energy with a relatively small electric current, and can utilize nuclear reactions that cannot be employed in small-sized cyclotrons. This cyclotron, as a medium-sized cyclotron, will produce nuclides that the small-sized cyclotrons cannot produce. (JA)

28356 AGREEMENT ON GERMAN EXPERIMENTS AT THE NEW SWISS ACCELERATOR. Pressedienst (Bundesmin. Bild. Wiss.); No. 26, 6-7(1972). (In German).

Remarks on the agreement between the German Federal Ministry for Science and Education (represented by the Nuclear Research Center Karlsruhe) and the Swiss Nuclear Institute (a body of the Technical High School Zurich) about the joint financing and use of the new 600-MeV proton accelerator in Switzerland are presented. This accelerator is designed for a high beam current and will be used for structural studies within the atomic nucleus. The agreement runs for the period from January 1, 1973 to December 31, 1976. (GF)

28357 CHEMICAL ACCELERATOR FOR THE STUDY OF THE DYNAMICS OF ION-MOLECULE REACTIONS OVER THE ENERGY

RANGE 0.1 TO 100 eV. Hierl, P. M.; Strattan, L. W.; Wyatt, J. R. (Univ. of Kansas, Lawrence). J. Mass Spectrom. Ion Phys.; 10: No. 4, 385-403(Feb 1973).

A beam instrument for the study of ion–molecule reactions is described. Both angular and velocity distributions of reactively scattered ions can be measured, as well as reaction cross sections as a function of ion energy. Such data are sufficient to characterize completely the dynamics of the reaction studied. Because of its wide energy range, high mass resolution, and high overall sensitivity, this instrument appears to have more extensive capabilities than previously described beam instruments. In addition, excitation functions and kinematic data are provided for the reactions $N_2^+ + H_2 \rightarrow N_2H^+ + H$ and $N_2^+ + D_2 \rightarrow N_2D^+ + D$ over the energy range 0.078–14 eV (c.m.). (auth)

Auxiliaries and Components

28358 (CONF-720908-) PROCEEDINGS OF THE FOURTH INTERNATIONAL CONFERENCE ON MAGNET TECHNOLOGY, BROOKHAVEN, 1972. Winterbottom, Y. (ed.) (Brookhaven National Lab., Upton, N. Y.). 1972. 825p. Dep. NTIS.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

110 papers were presented at the conference and a separate abstract was prepared for each of 70 papers. Eight of the papers were not within the scope of NSA. 30 papers were previously abstracted for NSA; for abstracts of these see CONF-720908 in the Report Number Index. (WHK)

For abstracts of individual papers see: 27678–27680, 27703–27706, 27755, 28359–28384, 28392–28395, 28399, 28410–28415, 28418–28422, 28851–28854, 28869–28878, 28880–28882, 29311, and 29312.

28359 (CONF-720908-, pp 119-125) CORRECTION MAGNET SYSTEM OF NAL MAIN ACCELERATOR. Juhala, R.; Maschke, A. W.; Mori, S.; Yamada, R. (National Accelerator Lab., Batavia, IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Several different types of correction magnets have been installed in the NAL Main Accelerator. Approximately 100 horizontal and 100 vertical correction magnets are used to correct injection field, which is affected mostly by the remanent field variation of main bending magnets. These magnets are independently controlled from the control room with individual dc power supplies. About 200 air core sextupole magnets are used to correct the sextupole field in the main bending magnets due to remanent and eddy current fields. These magnets are controlled simultaneously through three pulsed power supplies. Thirty-six trim quadrupole magnets and thirty-six iron core sextupole magnets will be used to correct high harmonic resonances. Twelve air core skew quadrupole magnets will be used to compensate coupling between horizontal and vertical motions. (auth)

28360 (CONF-720908-, pp 164-166) LOW STORED ENERGY, HIGH PRECISION SUPERCONDUCTING QUADRUPOLE FOR HIGH ENERGY BEAMS. Asner, A.; Leroy, D. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The construction of a low stored energy, high precision superconducting beam transport quadrupole is reported. This quadrupole, named "CASTOR," although designed as a prototype, is fully representative as an operational superconducting beam transport element. The construction was completed within 10 months and testing had started by the end of August 1972. The very successful quadrupole performance during its first run is given. (auth)

28361 (CONF-720908-, pp 167-173) DESIGN OF A LOW FRINGE FIELD SEPTUM MAGNET FOR USE AT THE CERN ISR. Ratner, L. G.; Lari, R. J.; Bywater, J. A.; Berrill, E. C. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A 1.2 m long × 5 cm high × 50 cm wide gap magnet with a field integral of 18 kG-meters was required to be placed within 5 cm of the Intersecting Storage Rings (ISR) circulating beam for the Argonne-Bologna-Michigan experiment at intersection region II. To preserve the circulating beam in the ISR, it is necessary to keep the fringe field gradient to less than 0.005 kG-meters/cm. This was accomplished by an independent, external correction coil which reduced the field in the coil retaining plate, thus reducing the leakage field. During actual operation at the CERN–ISR, the correction coils performed as predicted. They were indeed necessary to prevent ISR beam losses and it would not have been possible to perform the experiment without them. The utilization of the computer program TRIM to determine the iron, copper and correction coil winding configuration to achieve these conditions is described. The mechanical/electrical design and actual magnetic measurements obtained from the completed magnet are presented. (auth)

28362 (CONF-720908-, pp 203-226) PULSED SUPERCONDUCTING MAGNETS. Bronca, G.; Genevey, P.; Kircher, F.; Perot, J.; Pouillange, J. P.; Prost, G. (CEN, Saclay, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The possibility of using superconducting magnets to increase the energy of present accelerators or to get very high energy in new facilities, has been studied in many laboratories all over the world. The work concerning the theoretical aspect of the behavior of superconductors in pulsed fields, the present conductor status, the field tolerances and corrections, the magnet construction problems, and finally the experimental results obtained recently in testing coils of different sizes and shapes are reviewed. (60 references) (auth)

28363 (CONF-720908-, pp 306-315) KARLSRUHE PULSED SUPERCONDUCTING MAGNET PROGRAMME. Status Report. Schauer, W. (comp.) (Kernforschungszentrum, Karlsruhe, Ger.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The high magnetic field capabilities of superconducting materials make possible the construction of pulsed accelerator magnets which are especially suitable for large synchrotrons with low repetition rates. With the construction of the 300-GeV proton accelerator now under way at CERN, the application of high field pulsed superconducting magnets to increase the present machine energy to about 1000 GeV has been taken into consideration. Each group of the GESSS Collaboration, comprising the development teams at Rutherford Laboratory, CEN/Saclay and IEKP Karlsruhe, has built and is going to build and test several different prototype magnets which will be in line with the requirements of a superconducting accelerator concept. The Karlsruhe laboratory status report with respect to pulsed superconducting synchrotron magnets is given. (WHK)

28364 (CONF-720908-, pp 316-323) SACLAY SUPERCONDUCTING PULSED DIPOLE "MOBY". Berruyer, A. (CEN, Saclay, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A pulsed superconducting dipole is being built at Saclay. It will give a field of 6 T in a bore of 100 mm with an homogeneity better than 10^{-3} in 50% of the aperture. The current will be 1500 A and the minimum rise time 5 seconds. The synchrotron dipole has a cold iron shielding and will work in a horizontal cryostat. A considerable effort has been carried out to design this magnet as close as possible to an engineered version. Many parts are already delivered and the conductor has been tested on three solenoid coils. (auth)

28365 (CONF-720908-, pp 363-371) DESIGN OF THE BENDING AND QUADRUPOLE MAGNETS FOR THE MAIN RING OF THE JAPANESE 12 GEV PROTON ACCELERATOR. Endo, K.; Kihara, M. (National Lab. for High Energy Physics, Tsukuba, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The design features of the main ring magnet system of the Japanese 12-GeV proton accelerator are reported. Problems relating to the design of the dipole and quadrupole magnets are

discussed, including choice of the core material and the results of field computation with magnetostatic programs. (auth)

28366 (CONF-720908-, pp 372-380) DESIGN OF THE BOOSTER SYNCHROTRON MAGNET FOR JAPANESE 12 GEV PROTON SYNCHROTRON. Sasaki, H.; Takikawa, K.; Kumada, M. (National Lab. for High Energy Physics, Tsukuba, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A booster synchrotron for the Japanese 12-GeV proton synchrotron is under construction. Specially developed oriented steel is proposed for the core material of the magnet of the high repetition booster synchrotron. Present material shows good high-field characteristics, low loss and low coercive force. The data of the electromagnetic and mechanical properties of this material are presented in comparison with those of ordinary silicon steel. The results of the calculation of the magnetic field are shown and discussed. (auth)

28367 (CONF-720908-, pp 381-390) REPAIR OF ZGS RING MAGNET COIL DAMAGED CONDUCTOR SECTIONS. Bywater, J. A.; Niemann, R. C.; Sevcik, V. J.; Wehrle, R. B. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Two magnet coils of the Argonne National Laboratory's Zero Gradient Synchrotron suffered serious mechanical damage to conductor and insulation as the result of electrical shorting. The nature of the coils and the extent of damage are described. Methods of conductor repair considered are enumerated along with their corresponding advantages and disadvantages. The aspects of conductor repair; i.e., preparation, brazing, clean-up, etc., are presented along with test data generated by several feasibility studies. The actual repair of the conductor section with the use of fixturing which employs, as an advantage, the thermal expansion of the metal due to braze heating is presented in detail. (auth)

28368 (CONF-720908-, pp 391-401) REINSULATION OF THE REPLACED SECTIONS OF THE DAMAGED ZERO GRADIENT SYNCHROTRON RING MAGNET COIL. Benham, T. H.; Biggs, J. A.; Hoffman, J. A.; Markley, F. W.; McKamey, A. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The second aspect of the repair of the Argonne National Laboratory Zero Gradient Synchrotron Ring Magnet Coils was the reinsulation of the replaced damaged sections. The initial preparation of the sections, machining the existing insulation and installing the fitted insulation pieces, is described. A precision device for grinding the rigid insulation is detailed. The procedure for the two-step vacuum impregnation of the reinsulated coil sections with epoxy is presented. Steps necessary to insure a good epoxy flow and a void-free impregnation are given in detail. The reinsulation techniques described appear to have been successful since the coils are in use again in the Zero Gradient Synchrotron Ring Magnet. (auth)

28369 (CONF-720908-, pp 402-406) AIR-CORE MAGNETS FOR TRIMMING THE NAL BOOSTER SYNCHROTRON ORBIT. Juhala, R. (National Accelerator Lab., Batavia, IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Forty-eight assemblies of four magnets each were provided for making orbit corrections at injection to the booster synchrotron. This assembly consists of both horizontal and vertical bending magnets as well as a quadrupole and skew-quadrupole. The magnets are 13 inches long and are concentric cylinders with the quadrupole which is innermost having an aperture of $4\frac{3}{4}$ in. The differential form of Ampere's Law was used to calculate the field in three dimensions including ends. By adjusting the boundary defining parameters of the magnets the uniformity of the bending and gradient lengths were optimized. The dipoles provide a bending strength $\int Bdl$ of 0.03 kG-m which is calculated to be uniform to within 1% over a 3-inch aperture. The quadrupole focusing strength $\int B'dl$ is 0.22 kG with calculated deviations in the order of 1% inside a 3-inch aperture. (auth)

28370 (CONF-720908-, pp 415-422) NAL MAIN RING INTEGRALLY IMPREGNATED MAGNETS. Hanson, W.; Hinterberger, H.; Reardon, P. (National Accelerator Lab., Batavia, IL) 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The revised NAL Main Ring Magnet fabrication procedure consists of casting partially insulated coils, magnet cores, and vacuum tubes into an integral, void-free, monolithic structure. This design is regularly tested at 6000 V after complete submergence in water for one week. Corona tests were also done on several magnets to ensure that the insulation was sufficiently void-free to prevent the start of corona currents during operation. Mica, fiberglass, and polyimide film are squeezed into the 0.047 in. thick available space from copper to iron and impregnated with a highly filled alumina, glass bead, radiation resistant epoxy system. Mica and glass insulation are also used between turns and layers. The insulation system readily withstands 3500 V before impregnation and 6000 V after impregnation. Other advantages of this method are discussed. (auth)

28371 (CONF-720908-, pp 423-432) DESIGN AND MAGNETIC MEASUREMENT OF THE NAL MAIN ACCELERATOR BENDING MAGNETS. Yamada, R. (National Accelerator Lab., Batavia, IL); Schmidt, C.; Juhala, R.; Lari, R. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Profiles of the NAL Main Ring Bending Magnets were calculated by the computer program TRIM. The calculated field gradient $k = (dB/dx)/B_0$ is compared with the measured values. The effect of insulation thickness, shims, and imperfection of the dies are discussed. The selection criteria for the Main Ring Magnet steel are presented. The test procedures used for determining the coercive force, high field μ-value, surface resistivity and crown are described. The variations of these parameters during steel production are presented and the effect on the magnets discussed. Production magnetic field test procedures and the results are described. Data on the variations in magnetic length are presented for B1 and B2 magnets. (auth)

28372 (CONF-720908-, pp 627-635) TRANSFER FUNCTION FOR NAL MAIN RING DIPOLE AND QUADRUPOLE MAGNETS. Snowdon, S. C. (National Accelerator Lab., Batavia, IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The transfer function between the Fourier amplitudes of the central magnetic field and the excitation current has been calculated for NAL main-ring dipoles. A similar analysis also has been employed to obtain the transfer function between the Fourier amplitudes of the central gradient and the excitation current of the NAL main-ring quadrupoles. In each case the eddy currents in the laminations, vacuum chamber, and conductors are estimated and their effects in a magnetic circuit are found. The analysis also gives the impedances looking into the coil terminals. (auth)

28373 (CONF-720908-, pp 653-663) MAGNET COOLING SYSTEMS. Vander Arend, P. C. (Cryogenic Consultants, Inc., Allentown, PA). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Cooling and establishing steady state conditions of large superconducting magnets, as used for large bubble chambers, or of a series of smaller magnets, as used for beam lines or accelerators, requires removal of vast amounts of heat. Methods to obtain reasonably fast and efficient cooling are indicated. Special emphasis is placed on the temperature range of 4 to 10°K. In this temperature range, refrigeration becomes quite expensive and it may be quite difficult to change the inventory of a dc magnet system from dense helium gas to liquid helium. Preliminary design work for a superconducting magnet system of an accelerator is described. The system is a closed loop and employs supercritical helium which is pumped around the loop by a number of centrifugal pumps. Refrigeration is applied by a number of helium refrigerators which employ boiling liquid helium. Liquid helium storage dewars are used to provide storage and flywheel capability for the system. (auth)

28374 (CONF-720908-, pp 682-688) REFRIGERATION SYSTEMS FOR DC AND PULSED SUPERCONDUCTING MAGNETS IN HIGH ENERGY PHYSICS. Dean, J. W. (Rutherford High Energy Lab., Chilton, Eng.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The power requirements for cryogenic refrigeration systems for cooling both dc and pulsed superconducting magnets suitable for synchrotron and beam line application are examined. The power requirements of supercritical helium refrigeration systems operating near 5°K are found to appreciably exceed those of a liquid helium refrigerator operating at 4.5°K. The power requirements of supercritical helium refrigeration systems become lower than that of a 4.5°K liquid helium refrigerator near 6°K and above. Pulsed magnets periodically lose energy at a variable rate. It is found to be economically advantageous to design refrigerators for pulsed loads to operate at the average energy loss rate storing refrigeration during the below average and off-time of the duty cycle. This type of operation is best achieved when the magnet is cooled by a pool of boiling helium. The temperature gradient between the refrigerator and the magnet has been examined. Factors contributing to a helium distribution system temperature gradient that can easily be 0.3°K are elevation change, heat leak, pipe friction, heat transfer films, and conduction heat transfer. The refrigerator operating temperature need be lowered to accommodate this temperature rise resulting in a refrigerator power increase of approximately 40%/K. (auth)

28375 (CONF-720908-, pp 698-702) TRANSIENT PROTECTION SYSTEM FOR THE RING MAGNETS OF THE ZERO GRADIENT SYNCHROTRON. Praeg, W. F. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The ring magnet octants of the Zero Gradient Synchrotron are connected between four dc power supplies to achieve symmetry and reduced operating voltages with respect to ground. Rectifier faults and other equipment malfunctions disturb this symmetry and cause transients of as much as 5 kV between octant terminals and ground. In order to limit these transients, a solid state protection system has been installed. It operates within a few μsec. The system applies ground to the four octant phantom grounds, is capable of carrying 10 kA, and causes an emergency shutdown of the ring magnet power supply (RMPS) should any one of the phantom ground voltages exceed 300 V. This limits octant transient voltages to about 1.7 kV. In addition, the system returns energy stored in the magnets to the RMPS and stops RMPS pulsing if a phantom ground voltage is $250 < E < 300$ V. Visual indication of the location of the overvoltage to ground is provided. The transient voltages at the magnet coil terminals and at the phantom grounds are recorded on magnetic tape for diagnosing faults. (auth)

28376 (CONF-720908-, pp 703-708) FLUX PUMPS AND AC SUPERCONDUCTING COMPONENTS. Britton, R. B.; Abbatiello, F. J.; Robins, K. E. (Brookhaven National Lab., Upton, NY). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

In connection with the construction of ac to dc converters or flux pumps for powering dc superconducting beam magnets, several techniques were developed that improve the performance of the ac inductance coils, transformers, and magnetic switches used in the pump. Details of the construction of these components are discussed along with performance data on a 500 A pump built for a beam splitter magnet. (auth)

28377 (CONF-720908-, pp 709-717) PRELIMINARY TEST OF THE STATIC POWER SUPPLY FOR JAPANESE PROTON SYNCHROTRON. Masuda, M. (National Lab. for High Energy Physics, Ibaraki, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sept 1972).

In proceedings of the fourth international conference on magnet technology.

It is a recent trend to design the power system for a proton synchrotron by a direct connection of the power supplies to the power lines, for giving a solution to the mechanical failure in the motor generator set, which have been usually installed between the power supply and the power line to avoid the direct disturbance of varying load to the power line. In the Japanese proton synchrotron (8 to 12 GeV) the peak reactive power is 14 to 19 MVar depending on a designing point of the cycloconverter set. Without any protecting device, roughly 3% voltage fluctuation will be induced on the city power line. One method, a function of which is the continuous and quick response compensation of the voltage fluctuation by thyristors and with associated reactors, is presented. The model of the proper scale was installed to test the method in the power system of the model magnet. The reactive power has been completely compensated and the voltage fluctuation has been decreased from 3% down to 0.5%. The technical difficulties which will be supposed in an actual machine have been overcome and the cost estimation has shown much more economical merit than such methods that use the saturable reactors, multi-banks of capacitors with thyristor switches, and the motor generator set. (auth)

28378 (CONF-720908-, pp 718-724) REACTIVE POWER COMPENSATION OF THE CERN PS-BOOSTER POWER SUPPLY. Pahud, J. D. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The CERN Synchrotron Injector (PS-Booster) started operation in the spring of 1972. The pulsed power supplies for the bending magnets and quadrupole lenses are provided by static rectifiers connected directly to the network. Compensation of cyclic variations in reactive power was effected with particular care to ensure that perturbance of the supply network voltage was kept to a minimum. The characteristics of the cycle obtained on the magnets are given, followed by a more detailed description of the system of reactive power compensation. The measurement of the reactive power and the regulation loop are described and discussed. Several oscillograms show the operation of the PS-Booster with and without reactive power compensation. The results obtained demonstrate the usefulness of this device which enables the residual variations in voltage on the 18 kV busbar to be kept within an overall range of 0.5% peak to peak. Consequently, this variation is small enough not to interfere with other users connected to the same network. (auth)

28379 (CONF-720908-, pp 737-744) MEASUREMENTS ON PULSED SUPERCONDUCTING DIPOLE MAGNETS. Coupland, J. H.; Baynham, D. E. (Rutherford High Energy Lab., Chilton, Eng.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Measurements of the magnetic field in the bore of two superconducting dipole magnets are discussed after a brief description of the magnets, AC3 and AC4. The achieved field uniformity in the useful aperture of the iron yoked magnet AC4, though not yet sufficient, is approaching that required for a proton synchrotron. In the absence of any compensation of the remanent field, the rather large sextupole component, rising to 0.6 mT at the edge of the useful aperture in AC3 and 1.2 mT in AC4, will impose a lower limit on the injection energy into the synchrotron ring. (auth)

28380 (CONF-720908-, pp 745-751) ECONOMICAL AND ACCURATE METHODS FOR MEASURING THE MULTIPOLE FIELD COEFFICIENTS OF BENDING MAGNETS AND QUADRUPOLES. Lohmann, K. D. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

All relevant field parameters of bending magnets and quadrupoles can be measured with long straight coils, if the curvature of the particle trajectories inside these elements is not too great. The particular problems related to long coils are discussed, namely calibration, measuring errors, and mechanical layout. The measuring apparatus used for the CERN Proton Synchrotron booster magnets is discussed, comprising: (1) the long coil system for measuring bending magnets of 1.6 m length and 0.07 m gap height, featuring: simultaneous measurement in three planes; coil flipping with pneumatic motors; 0.003% relative accuracy; and simple mechanical construction. (2) the harmonic coil with compensation winding for measuring the quadrupoles. All multipole coefficients up to 28-pole ones are measured with an accuracy of 0.003% (multipole field referred to the quadrupole field at bore radius). The displacement of the magnetic centre with respect to the geometric centre of the quadrupole is measured to within 0.01 mm. The system requires

neither a precise angular position nor precise incremental rotation. (auth)

28381 (CONF-720908-, pp 765-766) METHOD FOR DETECTING CORONA WITHIN RING MAGNET COILS OF THE ZERO GRADIENT SYNCHROTRON. Dawson, J. W. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

During recent years interest has developed in monitoring corona in the ring magnet coils of the Zero Gradient Synchrotron (ZGS). The threshold of corona in the magnet coils is thought to impose a limit on the amplitude of voltage which may be supplied by the RMPS for reliable operation. Accordingly, a method was devised to detect corona originating in the magnet coils. This technique was implemented on the ZGS test fixture (a half octant) and studies indicated that single corona pulses could be reliably detected when transmitted on the test fixture coils or when buried within the test fixture. This corona monitoring method utilizes a high quality communications receiver to provide 5 μV sensitivity, which is adequate for the detection of single corona pulses of approximately 10^{-11} coulombs per pulse. With some modification, the method could be implemented to provide on-line continual corona monitoring of magnet coils during acceleration. (auth)

28382 (CONF-720908-, pp 767-772) MAGNETIC FIELD SURVEY SYSTEM FOR THE TRIUMF CYCLOTRON MAGNET. Auld, E. G.; Livesey, D. L.; Otter, A. J.; Rehlinger, N. (TRIUMF, Vancouver, Can.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The basis of the survey system is 105 equally spaced flip coils mounted on a 27 ft aluminum I beam which rotates inside the 17.5 in. high vacuum tank. The I beam is moved through 1 deg increments (accurate to ±0.01 deg) by an air-driven indexing system capable of rotating both clockwise and counterclockwise. The coil signals are integrated and measured by a Reed scanning data acquisition system with a resolution of better than 1×10^{-5}. The overall absolute accuracy of the system is better than 1×10^{-4} at 5 kG. The acquisition of the data and the control of the I beam is handled by a 16 k core computer. (auth)

28383 (CONF-720908-, pp 773-778) PORTABLE DEVICE TO MEASURE LOW MAGNETIC PERMEABILITY IN SITU. Gourber, J. P. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A new and portable device for measuring low magnetic susceptibility at high field levels is described. The test material is used to close the air gap in a magnetic circuit (probe) in which the magnetizing field is given by a small permanent magnet. The change in flux is measured and the susceptibility is displayed on a digital voltmeter. The theory is given for an ideal probe. The choice of the permanent magnet material and the design of the probe are discussed. The probe was developed to measure the skin susceptibility on the austenitic manganese stainless steel pillars which support the top part of the large analyzing magnet ("Split Field Magnet") which is now being assembled for the Intersecting Storage Rings (ISR) at CERN. Two probes were made for measuring the skin permeability in situ on large mechanical components. Results of the calibration and of various measurements are given. (auth)

28384 (CONF-720908-, pp 779-786) PRECISE SEMIAUTOMATIC FIELD MAPPING IN THE SPLIT FIELD MAGNET OF THE ISR. Billan, J.; Grillet, J. P.; Henrichsen, K. N.; Schaeff, F. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The computer-controlled equipment for the magnetic measurements of the Split Field Magnet System of the CERN Intersecting Storage Rings is described. Three different measurement machines are necessary for the measurements of this large and complex magnet system. The strongly inhomogeneous field is measured to a precision of 1% of maximum field using Hall-plate assemblies. The final data treatment includes the smoothing out of the established scalar potential by solving the Laplace's equation from the conditions at the boundaries by means of relaxation. The three-dimensional field map will be used for particle analysis. Effects of the SFM-field on the circulating ISR beams are evaluated and optimized. (auth)

28385 MEASURING SYSTEM OF SLOWLY VARYING LOW FIELD FOR GRADIENT MAGNETS. Endo, K.; Sasaki, H. (National Lab. for High Energy Physics, Ibaraki, Japan). Nucl. Instrum. Methods; 108: No. 1, 193-195(1973).

The peaking strip method has been widely used to measure the dynamic low field of the electron synchrotron magnets. In those cases, because of rapid change of the field (more than 100 kG/s), the voltage induced in the pickup coil wound on the peaking (permalloy) strip, is high and sharp. Accordingly, field measurements are comparatively easy compared with those of slowly varying low fields in the case of the slow cyclic proton synchrotron. As the rate of change of the field in the present case is as low as 3 kG/s, the signal is so small that the accurate measurement is difficult. In order to overcome such a difficulty, a modified peaking strip method, which uses the high frequency carrier to increase the signal-to-noise ratio, has been developed. By the use of this method, the magnitude of the signal increases more than 10 times at 3 kG/s, in comparison with the signal obtained when the high frequency carrier is not applied. (WHK)

28386 RESTORATION TO TRANSPARENCY OF RADIATION-BLACKENED PYREX. Sherman, N. K. (National Research Council of Canada, Ottawa). Nucl. Instrum. Methods; 108: No. 1, 29-31(1973).

Glass which is damaged by ionizing radiation becomes opaque to visible light because of absorption by trapped electrons, which form "colour centres." Objects made of glass may have to be discarded after receiving absorbed doses which have affected their transparency but not their mechanical integrity. A practical method of restoring the transparency of irradiated Pyrex by bleaching the colour centers with ultraviolet light is described. Pyrex windows on an accelerator beam tube operating at a pressure of 1×10^{-7} torr which became opaque due to megarad absorbed doses of ionizing radiation were repeatedly restored to transparency in situ without affecting the vacuum in the pipe. (auth)

28387 SHIELD FOR A LINEAR ELECTRON ACCELERATOR. Ablewicz, Z.; Jozwik, B. (Biuro Studiow i Projektow Energoprojekt, Warsaw). Przegl. Budowlany; 44: 340-342(1972). (In Polish).

Design and construction of an r.c. bunker used as a shield against the ionizing radiation from an accelerator are presented. Emphasis is placed on the selection of the shield material, type of structure and its proper realization. (auth)

28388 DESIGN OF SHIELDING: SHIELDING OF A PARTICLE ACCELERATOR FOR MEDICAL TREATMENT. Genshi Doryoku Kenkyukai Teirei Kenkyukai Nenkai Hokokusho; No. 45, vp(Aug 1971). (In Japanese).

Design studies for shielding for betatron and linear accelerators for use in radiotherapy are reported. (TFD)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 28198.

28389 (BNL-17648) INJECTION INTO THE ISA. Blewett, J. P.; Chasman, R.; Cottingham, J. G.; Courant, E. D.; Month, M.; Raka, E.; van Steenbergen, A. (Brookhaven National Lab., Upton, NY). 1972. 3p. (CONF-730310-12). Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

Three modes of injection into the ISA storage accelerators are discussed. The three are: (1) energy stacking in the ISA, (2) acceleration of 12 bunches in the AGS followed by single bunch transfer to the ISA. Application of a moving bucket technique then allows the transferred bunch to be brought closer to the bucket train circulating in the ISA, and (3) acceleration on the first harmonic in the AGS. The single bunch is then transferred directly to the ISA into a matched bucket. (auth)

28390 (BNL-17665) COMPUTER CONTROL OF BROOKHAVEN 200 MeV LINAC. Weitman, I. (Brookhaven National Lab., Upton, NY). 1970. 3p. (CONF-730310-18). Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

A unified control system philosophy allows operation of the linac from a PDP-8 mini-computer with full supervisory control, data

acquisition and the full computation capability of the PDP-10 located at the AGS. Interface hardware for diagnostic monitoring equipment and operational control equipment is described. Failure of any link in the control system does not necessitate shutdown of the linac, only a diminished control capability results. (auth)

28391 (BNL-17666) CLOSED ORBIT CORRECTION IN THE AGS. Herrera, J. C.; Gill, E. C. (Brookhaven National Lab., Upton, N. Y.). 1971. 3p. (CONF-730310-14). Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

In order to utilize efficiently the available aperture in the AGS and thereby achieve a high intensity accelerated beam, it is important that deviations in the horizontal and vertical equilibrium orbits be minimized. As has been emphasized, this is particularly true when multiturn injection is used. The AGS conversion program has provided the synchrotron ring structure with 96 horizontal and 96 vertical dipole magnets located at the 2, 4, 6, 8, 12, 14, 16, 18 straight sections of each superperiod. Each of these correction dipoles is independently powered and capable of giving the beam an angular deflection of 0.15 mrad for the injection momentum (8.46×10^8 gauss in.). The position of the beam in the AGS is observed with the aid of 36 horizontal and 36 vertical electrostatic induction electrodes located azimuthally at the 3, 7, and 15 straight sections of each of the superperiods. (auth)

28392 (CONF-720908-, pp 114-118) RESONANT EXTRACTION MAGNET AT THE ZERO GRADIENT SYNCHROTRON. Ratner, L. G.; Lari, R. J.; Bywater, J. A.; Berrill, E. C. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A sextupole field over ±5 in. was required for resonant extraction at the Zero Gradient Synchrotron (ZGS). The desired maximum product of effective length times d^2B/dx^2 was 1.0 kG-ft/in.^{2}. In addition, this parabolic shaped field was made adjustable with the addition of a dipole coil, so as to translate the whole parabola up or down. The magnet was designed as a "C" frame magnet of clear aperture 5.5 in. high by 32 in. wide to match the vacuum chamber dimensions of the ZGS. The utilization of the computer program TRIM to determine the steel and copper configuration is described. In addition, the mechanical/electrical design and actual magnetic measurements of the completed magnet are presented. (auth)

28393 (CONF-720908-, pp 135-143) KICKER MAGNET FOR THE FAST EJECTION SYSTEM OF THE SERPUKHOV 70 GEV PROTON ACCELERATOR. Frick, E.; Kuiper, B.; Messina, A.; Riege, H. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The full aperture kicker magnet produces a field of 0.1 T with a rise-time of 150 nsec in an aperture of 140×100 mm^2 and over a magnetic length of 3 m. It is a two-section L-C network incorporated in a delay line pulser circuit. Its construction and performance are described. (auth)

28394 (CONF-720908-, pp 144-152) SEPTUM MAGNETS FOR THE FAST EJECTION SYSTEM OF THE SERPUKHOV 70 GEV PROTON SYNCHROTRON. van Breugel, H.; Cuenot, R.; Herin, S.; Kuiper, B. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Two single excitation loop septum magnets, one moving, the other stationary, have, respectively, magnetic lengths of 1.5 m and 3 m and produce fields of up to 1 T and 1.4 T in apertures of 35×30 mm^2 and 60×30 mm^2. Field corrections resulted in a spatial homogeneity of the kick of better than 0.1% for excitation levels corresponding to ejection at proton energies between 30 and 76 GeV. Construction and performance are described. (auth)

28395 (CONF-720908-, pp 153-156) RADIATION RESISTANT LAMINATED SEPTUM MAGNET. Edwards, H.; Hubbard, E. L.; Juhala, R. (National Accelerator Lab., Batavia, IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A pulsed septum magnet is used to inflect the 200 MeV beam into the booster synchrotron at the National Accelerator Laboratory. The magnet which is approximately 1 meter long is excited by a single turn coil to 3.3 kG at 10,000 amperes. Instead of supporting the septum with insulating material which is subject to radiation damage, the septum is welded to the magnet laminations. The current is confined to the septum by the insulation between the laminations which is a standard core plate material. The aperture is $1\frac{1}{2}$ in. high × 2 in. wide. The field is a half sine wave with a width of 400 μsec which provides a peak field uniformity of 0.1% for a duration of 12 μsec as required for injection. (auth)

28396 (CONF-730310-15) ENERGY MULTIPLICATION BY BEAM RECYCLING IN AN ISOCHRONOUS CYCLOTRON. Hudson, E. D.; Mallory, M. L.; Lord, R. S.; Zucker, A.; Blosser, H. G.; Johnson, D. A. (Oak Ridge National Lab., Tenn.; Michigan State Univ., East Lansing. Cyclotron Lab.). 1972. 5p. Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

An initial computer study of a recycling method for increasing the final energy of heavy-ion beams from the ORNL Isochronous Cyclotron (ORIC) was made. The system involves simultaneous acceleration of two beams. A first beam originating either in an ion source or external injector is accelerated, extracted, and reinjected in a higher charge state obtained by means of a foil located between the turns of the first-pass beam. For example, with a 20 MV tandem injecting into ORIC the energy for ^{208}Pb after the first pass would be 1.9 or 2.3 MeV/u and after the second pass 5.2 or 6.3 MeV/u depending on the injection charge. The requirements of this scheme are: (1) sufficient dee voltage to override the differing mass increase factors of the 2 beams; (2) good beam quality and accelerator stability to insure spatial separation of orbits; (3) an all-magnetic extraction system to assure identical paths for the 2 beams; and (4) relatively standard external beam separation and reinjection equipment. (auth)

28397 (CONF-730310-16) CYCLOTRON INTERNAL ION SOURCE WITH DC EXTRACTION. Mallory, M. L.; Hudson, E. D.; Lord, R. S. (Oak Ridge National Lab., Tenn.). 1972. 5p. Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

A method for increasing the intensities for heavy ion beams accelerated in isochronous cyclotrons at high harmonics ($h \geq 5$) of the orbit frequency is described. Normally, only small intensities are obtained at high harmonics because of the low effective accelerating voltage between the ion source and the puller electrode. A dc ion extraction system for the Oak Ridge Isochronous Cyclotron was developed and tested. Use of the dc extraction system has increased beams of $^{40}Ar^{3+}$ on the 5th harmonic and $^{20}Ne^{1+}$ on the 7th harmonic from nanoamperes to microamperes. (auth)

28398 PROPERTIES OF ION BEAM FROM DUOPLASMATRON. Bose, D. K.; Sengupta, S. N.; Nagchaudhuri, B. D. (Saha Inst. of Nuclear Physics, Calcutta). pp 489-494 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

Ion Optics and Field Calculations

Refer also to abstract 29027.

28399 (CONF-720908–, pp 182-187) BEAM ROTATOR. Kowalski, S.; Enge, H. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A magnetic system has been designed which in TRANSPORT notation effects the transformation $x \rightarrow -y$ and $y \rightarrow -x$ or $x \rightarrow y$ and $y \rightarrow x$ on the coordinates of the beam. This is in effect a 90° rotation of the mirror image of the beam cross section. The system consists of a symmetric arrangement of five quadrupole magnets whose symmetry axes are at 45° to their normal orientation. Longitudinal disposition of the quadrupoles along the beam axis is variable and may be adjusted to a configuration whose optical length corresponds to its physical length. The most obvious use of such a system is in conjunction with energy-loss spectrometer arrangements. In this case, for spectrometers arranged to analyze scattered particles in a vertical plane, the beam rotator converts the normal horizontal dispersion of the typical beam handling system into a vertical dispersion required for the energy-loss technique. Such a system has been designed for the MIT Energy-Loss Spectrometer and similar systems have been proposed for

the LASL high resolution proton spectrometer and also the DARMSTADT electron linac. (auth)

28400 EXPANSION OF CYLINDRICAL BEAMS DUE TO SPACE-CHARGE EFFECTS WITH UNIFORM ACCELERATION. Nemes, M. (Inst. of Atomic Physics, Bucharest). Nucl. Instrum. Methods; 108: No. 1, 201-202(1973).

Numerical graphs for deriving envelopes of cylindrical beams in the presence of space-charge effects and uniform acceleration were presented by Hara (Nucl. Instr. and Meth. 63 (1968) 313). This letter presents similar graphs in a range of initial beam-divergences not discussed by Hara. (auth)

28401 SYNCHRONOUS MOTION OF CHARGED PARTICLES IN A FIELD OF TRAVELING WAVES. Mokhov, V. M.; Kushin, V. V. At. Energ. (USSR); 34: No. 3, 209-210(Mar 1973). (In Russian).

Conditions are investigated for the emergence of two stable, synchronous phases in a traveling wave, the amplitude and phase of which periodically alter in the direction of the motion of the particles. The results of accurate calculations of phase trajectories of particles and their approximate evaluations by an averaging method agree with measured values. (KSW)

28402 SECOND ORDER SPHERICAL ABERRATION DUE TO A DIPOLE MAGNET. Bhattacharya, N. C.; Sethi, R. C.; Bhandari, R. K.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 523-530 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28403 EFFECT OF MAGNETIC FIELD ERRORS ON ORBIT PROPERTIES IN CYCLIC ACCELERATORS. Jain, A. (Bhabha Atomic Research Centre, Trombay, India). pp 531-535 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28404 MEASUREMENT AND EVALUATION OF THE FRINGING FIELD EFFECTS IN A 2 CM QUADRUPOLE MAGNET. Sethi, R. C.; Jain, A.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 537-543 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28405 BEAM DYNAMIC STABILITY STUDIES FOR THE 224 CM VARIABLE ENERGY CYCLOTRON. Jain, A.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 543-546 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28406 RADIAL MOTION STUDIES IN THE 224 CM VARIABLE ENERGY CYCLOTRON. Bhandari, R. K.; Bhattacharya, N. C.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 547-553 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy(1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28407 GENERALIZED RELATION FOR ESTIMATING THE INTENSITY LIMIT OF A BETATRON. Geske, G. (Friedrich–Schiller Univ., Jena). Kernenergie; 15: No. 9, 317-324(Sep 1972). (In German).

Starting from the stabilizing potential V_s of the magnetic guide field of a betatron, a generalized relation for the limit of intensity of a betatron is derived using an analytical simple configuration of the magnetic field with some special presuppositions in addition. From the theoretical results, constructional conclusions have been drawn to approach this limit as close as possible. (auth)

Storage Rings

28408 (BNL-17647) CONTROLLING NONLINEAR RESONANCES IN SUPERCONDUCTING STORAGE ACCELERATORS. Parzen, G. (Brookhaven National Lab., Upton, N. Y.). 1972. 3p. (CONF-730310-17). Dep. NTIS $3.00.

From 5th particle accelerator conference; San Francisco, California, USA (5 Mar 1973).

There is reason to expect that nonlinear imperfection resonances may be stronger in a high field superconducting storage accelerator than in a storage accelerator using conventional magnets. A rough study is done to estimate the minimum correction magnets required to correct for resonances up to an including the fifth order. It may be sufficient to have roughly one correction magnet in each cell of the storage ring, with each correction magnet having 12 different coils which are independently excited, and with about 36 independent power supplies. It is also suggested that these correction magnets may be used as all purpose correction magnets and correct for the linear resonances, central orbit displacements, and move the working point ν_r, ν_z as well. In this case, about two correction magnets are required per cell, each correction magnet having 21 different windings, and with about 132 independent power supplies required. (auth)

28409 (CONF-720582-, pp 111-114) FUTURE PROSPECTS OF COLLIDING-BEAM ACCELERATORS. Pellegrini, C. (CNEN, Frascati, Italy). 1972.

From Informal Meeting on Electromagnetic Interactions; Frascati, Italy (2 May 1972).

The status of colliding-beam storage rings now operating or under construction is tabulated and discussed. Also beam luminosity limitations are briefly discussed. (WHK)

28410 (CONF-720908–, pp 80-86) MAGNETIC ANALYZER FOR COLLIDING BEAM EXPERIMENTS IN A STORAGE RING. Catitti, A.; Cattoni, A.; Sacerdoti, G. (CNEN, Frascati, Italy). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A general survey of the project criteria of a magnet to get a uniform magnetic field to detect the products of the e^+e^- reactions is presented. The particular project chosen, to be used in connection with the "Adone" storage ring at the Frascati Laboratory, is described; and some details are given regarding how to compensate the field produced by the magnet on the machine orbit in the straight section. (auth)

28411 (CONF-720908–, pp 126-131) LARGE SOLID ANGLE SUPERCONDUCTING IRONLESS MAGNET FOR THE DESY STORAGE RINGS. Besch, H. J.; Trinks, U. (Univ., Bonn). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

For the DESY storage rings a superconducting magnet for a large solid angle magnetic detector is under construction. The magnet consists of 8 identical nearly rectangular ironless coils, which are arranged like butterfly wings around the beam at the interaction point to produce a circular field decreasing very rapidly near the beam and outside, thus requiring no magnetic shielding. Each coil is contained in its own cryostat and carries a current of 1.2×10^6 A in a cross section of 176 cm^2. The magnet covers polar angles between 40 and 140 degrees providing a solid angle of 7.3 sr. The integrated field length is 19 kG · m. The total length is 4 m, the free inner diameter is 1.3 m and the total diameter is 5.5 m. As the current density is very high, one test coil will be set up first. A magnet of this type may be useful also for large solid angle spectrometers connected with a tagged photon beam. (auth)

28412 (CONF-720908–, pp 275-286) 1.4 m/2.2 T SUPERCONDUCTING DETECTOR MAGNET PLUTO FOR THE ELECTRON-POSITRON STORAGE RING AT DESY. Parsch, C. P. (Siemens A.G., Erlangen, Ger.); Bartosch, E.; Boehm, F.; Horlitz, G.; Knust, G.; Wolff, S.; Stephan, A.; Hauck, D. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The design and operation of the PLUTO superconducting detector magnet for pulse analysis of high-energy elementary particles at a crossing point of the DORIS electron-positron storage ring are described. (WHK)

28413 (CONF-720908–, pp 287-294) SUPERCONDUCTING FIELD COMPENSATION COIL FOR THE 1.4m/2.2 TESLA SUPERCONDUCTING DETECTOR MAGNET "PLUTO" AT DESY. Eschricht, W.; Fiebig, H. J.; Horlitz, G.; Knopf, U.; Knust, G.; Nowakowski, K. D.; Peters, O.; Stahlschmidt, W.; Wolff, S. (Deutsches Elektronen-Synchrotron, Hamburg). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A superconducting coil has been constructed in order to compensate the magnetic field along the axis of the superconducting 1.4 m/2.2 Tesla magnet "Pluto" which will be used as a detector magnet at the intersection point of the storage ring at DESY. Within a region of r < 4 cm around the magnet axis the magnetic induction is reduced to the following limits: $B_z < \pm 5 \cdot 10^{-3}$ T, $B_R < \pm 2 \cdot 10^{-3}$ T and $\int B_R(z)dz < 10^{-3}$ T · m. Because of the shape of the "Pluto" field at the ends of its axis a solenoid consisting of several sections with different currents was necessary. The coil material and the walls as well as the total thickness of the cryostat were reduced to a minimum in order to increase the accuracy of the momentum measurement for the particles to be detected. A maximum of 0.6 radiation lengths or 0.11 collision lengths will not be exceeded for particles traversing the coil at 90° with respect to the magnet axis. The mean current density in the coil will be $3.2 \cdot 10^4$ A/cm^2. The design of the coil and the cryostat is described in detail; the computed final shape of the field along the magnet axis is given. (auth)

28414 (CONF-720908–, pp 433-443) SPLIT FIELD MAGNET OF THE CERN INTERSECTING STORAGE RINGS. Billan, J.; Perin, R.; Sergo, V. (CERN, Geneva). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The Split Field Magnet, presently under erection at CERN, is a general purpose system providing a magnetic field volume of 28 m^3 for the analysis of the products of proton-proton collisions in the ISR. The large size and power and the uncommon shape required special mechanical and electrical engineering solutions. A unique problem of beam optics and magnetic field shaping arises from the fact that the magnet is placed on an intersection of the ISR, with both proton beams crossing its field through about 11 m of length. The bending action is compensated by two additional magnets per beam: a small high field window frame magnet placed upstream of the intersection and a large H-type magnet with asymmetric return yokes placed downstream. The strong focusing effects (about 2.4 T of integrated field gradient) occurring to the incoming beams at the edge of the magnet and at the junction of the two magnet halves, are suppressed or compensated by passive beam channels which can be adjusted to all working conditions of the magnet. (auth)

28415 (CONF-720908–, pp 674-681) PRECISION DIRECT CURRENT TRANSFORMERS WITH ACTIVE ELEMENTS: A PROGRESS REPORT. Fry, M. G. J. (Brentford Electric Ltd., Crawley, Eng.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The principal features are recalled of the Brentford DC Transformers which measure the excitation currents of the main ring and beam transfer magnets of the CERN ISR, with reproducibility errors of a few parts per million. The power supplies for the DESY ISR now under construction at Hamburg, West Germany, require similar precision stability with greatly enhanced linearity and signal-to-noise ratio. The main sources of instrument errors are analyzed, and it is demonstrated how these may be reduced or eliminated by the addition of simple active elements to the basic passive element circuit. Some details are quoted of the performance improvements obtained on development models in the laboratory with the use of these active-element circuits, and some general remarks on the costs of the new circuits under discussion are given. (auth)

28416 COLLIDING-BEAM ACCELERATORS. Pellegrini, C. (CNEN, Rome). Annu. Rev. Nucl. Sci.; 22: 1-24(1972).

Topics include single particle motion in storage rings, limits on stored current and current density, beam lifetime, luminosity and its limitations, and coherent instabilities. A table of colliding-beam storage rings in operation and under construction is given. (76 references) (WHK)

Experimental Facilities

Refer also to abstracts 27624, 27712, 28340, 28614, 28644, 29054, and 29122.

28417 (BNL-17768) DEFLECTING CAVITIES WITH LARGE APERTURES. Bauer, W. (Brookhaven National Lab., Upton, N. Y.). 26 Feb 1973. 9p. Dep. NTIS $3.00.

Among the dimensions determining the properties of a deflecting cavity for an rf particle separator the iris diameter 2a plays an outstanding role. The pros and cons for apertures larger than presently used are discussed. (auth)

28418 (CONF-720908–, pp 87-91) CONSTRUCTION OF A TWO MAGNET TYPE BROAD RANGE PARTICLE ANALYZER AND MEASUREMENT OF ION-OPTICAL PROPERTIES BY USE OF IT. Nakanishi, N.; Motonaga, S.; Matsuda, K.; Takeda, S.; Hemmi, M.; Inoue, T.; Fujita, J.; Nakajima, H.; Awaya, Y. (Inst. of Physical and Chemical Research, Saitama, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A magnetic analyzer used for nuclear reaction particles was constructed in association with the IPCR 160 cm cyclotron, by which the ion optical properties are determined. The magnetic analyzer was designed to satisfy the following conditions, (i) momentum resolution of $\Delta p/p \leq 2.5 \times 10^{-4}$, (ii) luminosity of 2.5×10^{-3} sr, (iii) large dispersion, (iv) small magnification of vertical image, (v) straight focal line and (vi) broadness of the momentum range of ±10%. It is composed of two sectorial magnets which have a homogeneous magnetic field and curved pole boundaries. Such a complex configuration was chosen to meet the above conditions and ion optical properties. Two magnets have an air gap of 58 mm and their maximum magnetic rigidity and magnetic-motive force are 1210 kG · cm along the standard trajectory and 7.5×10^4 ampere turns, respectively. One of them is 32 tons and the other is 30 tons in total weight. The analyzer is rotated over an angular range from −15° to 140° around the center of a 500 mm diam scattering chamber. Some optical properties required are as follows: (i) deviation of the focal line from a straight line is less than 5 mm, (ii) momentum resolution and dispersion factor projected on the focal line are 2.5×10^{-4} and 6, respectively, on several points along the straight line, and (iii) solid angle is of about 1.9×10^{-3} sr. (auth)

28419 (CONF-720908–, pp 201-202) DC SUPERCONDUCTING MAGNETS. Purcell, J. R. (Argonne National Lab., IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Most of the large superconducting magnets that have been tested or will be tested soon are briefly reviewed, and a comparison table of main interesting parameters is presented. (auth)

28420 (CONF-720908–, pp 407-414) DESIGN OF NAL EXTERNAL BEAM LINE QUADRUPOLES. Ascolese, F.; Billinge, R.; Edwards, H.; Hanson, W.; Juhala, R.; Maschke, A.; Michelassi, J.; Reardon, P.; Snowdon, S. (National Accelerator Lab., Batavia, IL). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The 3-inch aperture quadrupole magnets used in the extracted proton beam lines and in some secondary beam lines at the National Accelerator Laboratory produce a gradient of 5 kG per inch with 100 ampere excitation and a voltage of 225 V. The 10-foot long laminated core consists of four separate quadrants punched from main ring magnet steel welded together and completely vacuum impregnated with coils and vacuum chamber in place. The four coils each contain 118 turns of #3 U. S. gauge solid square copper insulated with a polyimide coating. Conduction cooling is provided by water-cooled fins located between conductor layers. The designed gradient is uniform to 1% over the 3-inch aperture. (auth)

28421 (CONF-720908–, p 636) 3D MAGNETIC FIELD COMPUTATIONS AND COMPARISON WITH MEASUREMENTS. Christian, R. (Purdue Univ., Lafayette, IN); Vogel, H. F. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

3D calculations have been made for an H frame magnet mounted in a steel box for a d-c separator. In the computations, steel is assumed to be of infinite premeability. Measurements have been made on this magnet, which are compared with the computations. (auth)

28422 (CONF-720908–, pp 664-673) POWER SUPPLIES FOR MAGNETS. Winje, R. A. (National Accelerator Lab., Batavia, IL); Reardon, P. J.; Schoop, E. R.; Manahan, W. A. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

At the National Accelerator Laboratory, excitation of magnets in the beam lines external to the accelerator requires power supplies with widely varying output ratings and a stable behavior in non-laboratory environments. The problem was solved by the design of a single power supply with nine different dc power arrangements using the same primary ac connection. A description of this twelve phase 500 kW power supply in which the four internal 100 V, 1250 A half-wave units can be interconnected in different ways is given. This is followed by a description of the components of the power circuit, the design of the regulator, and the control system. A description of the mechanical arrangement of the power supply and a report of the performance obtained are included. (auth)

28423 (IFVE-SEF-71-112) DEVICE TO MEASURE THE LENGTH OF LIQUID HYDROGEN TARGETS. Dmitrevskii, Yu. P.; Elistratov, V. V.; Prudkoglyad, A. F. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1971. 8p. (In Russian). INIS.

Optical equipment is described for measuring the length of liquid hydrogen targets and the buckling of their beam windows in the cold state through transparent windows of a vacuum housing at distances of from 110 to 850 mm with an accuracy of 0.1 mm. (tr-auth)

28424 (JUL-891-KP) PHAS: A PULSE HEIGHT ANALYSIS SYSTEM FOR A PDP-15 CALCULATOR. Mertens, B. (Kernforschungsanlage, Juelich (West Germany). (Institut fuer Kernphysik). Oct 1972. 54p. (In German). Dep. NTIS (U. S. Sales Only) $4.75.

The pulse height analysis system (PHAS) accumulates the data and controls the nuclear physics experiments on the isochroncyclotron of the nuclear research center at Juelich. The experiments produce analog signals which contain information about energy, time, and space and which are transformed into digital signals by a converter. These signals are then fed through an interface into the storage core of the computer PDP-15. Two types of storage are possible. The increment mode increases by +1 the content of the storage cell which is addressed by the digital word. The list mode stores the digital words successively as a list in the core. The two modes allow both one-parameter and two-parameter analyses. In the one-parameter analysis, single events are picked up independent of other events. In the two-parameter analysis, only coincident events are registered. (tr-auth)

28425 METHOD OF MEASURING ALPHA-DECAYS IN THE NANOSECOND RANGE. Nomura, T.; Hiruta, K. (Inst. of Physical and Chemical Research, Saitama, Japan). Nucl. Instrum. Methods; 108: No. 1, 61-66(1973).

A simple pulsed-beam technique of measuring short-lived α-decays is described. In this method α-activities formed by nuclear reactions are stopped within a target used and α-decays are measured between natural beam bunches of a cyclotron with the help of fast electronics. The lower limit of measurable half-lives is determined by the time spread of beam bursts and is usually a few nanoseconds. An anisotropic angular distribution has been observed by this method for α-particles having non-zero angular momenta, which gives an essentially new possibility for alpha spectroscopy. Other important features of this method as a new spectroscopic tool are also discussed. (auth)

28426 MEASUREMENT OF THE ABSOLUTE TRANSPORT EFFICIENCY FOR RECOILS FROM HEAVY ION REACTIONS WITH He-JET SYSTEMS. Schmidt-Ott, W. D. (Georgia Inst. of Tech., Atlanta); Mlekodaj, R. L.; Bingham, C. A. Nucl. Instrum. Methods; 108: No. 1, 13-21(1973).

The complex problems involved in the transport of reaction recoils with He-jet systems have been investigated. The recoils ^{149,150,151}Dy produced in the reactions ^{141}Pr(^{14}N; 6, 5, 4n) were stopped in He gas and transported with the He flow through teflon, stainless steel, and glass capillaries. From the recoils knocked out of the target, 65% were transported through a 0.86 mm i.d. teflon capillary of 5 m length, 75% through a 2.25 m stainless steel capillary. The dependence of the transport efficiency on various parameters was investigated. The transport efficiency was increased by a small amount of carbon tetrachloride injected into the target chamber. In order to transport the reaction products from the high pressure region necessary to stop the recoils into a low pressure region where in future experiments an ion source can be operated, various glass-capillary-skimmer systems and also a double vacuum chamber evacuated by booster jet pumps have been tested. With the glass-capillary-skimmer system and using differential pumping with mechanical pumps only, about 30% of the recoils were brought into a region with a 3×10^3 times smaller pressure. Using two booster pumps and the double vacuum chamber with one 1.5 mm brass skimmer, 46% of all the recoils were introduced into the second vacuum chamber where the pressure is 10^6 times smaller than in the target chamber. The opening angle of the cone into which the recoils from the He-jet are emitted has been measured by radiograms to be 3°. The double vacuum chamber was put on high potential during the operation without the occurrence of a gas discharge. (auth)

28427 MEDICAL POSSIBILITIES OF SIN-ACCELERATORS. Mueller-Duysing, W.; Perret, C. (Kantonsspital, Zurich). Nucl.-Med., Suppl.; No. 9 Suppl., 349-355(1971). (In German).

From results of clinical nuclear medicine, diagnostic, therapy, research conference; Zurch, Switzerland (25 Sep 1969).

See CONF-690992--.

The SIN installation comprises two accelerator steps. The first step is an injector cyclotron which yields various particles and energies. The second cyclotron accelerates the 68 MeV protons from the injector cyclotron to a fixed energy of 585 MeV. The medical applications of the installation are discussed. The discussion centers on therapy with negative pions, therapy with protons, therapy with neutrons, radio-surgery, isotope production, and activation analysis. (HBG)

28428 HIGH YIELD NEUTRON GENERATOR FOR RADIOTHERAPY PURPOSES. Brennan, J. T. (Univ. of Pennsylvania, Philadelphia); Hendry, G. O.; Herring, D. F.; Hilton, J. L.; Kim, J.; Quam, W. M. Brit. J. Radiol.; 46: No. 543, 233(Mar 1973).

A relatively inexpensive, compact, 14-MeV neutron generator, adequate for clinical use, is very briefly described. It consists of a duoplasmatron ion source, a single high-voltage acceleration gap, and a thin water-cooled chromium target. The source is fed with a deuterium-tritium gas mixture and the accelerated ions quickly saturate the target surface. A small fraction of the incoming deuterium and tritium ions reacts with deuterium and tritium nuclei previously buried in the surface, to produce 14 MeV neutrons. Foil activation measurements yielded a source strength of 2.05×10^{12} neutrons/s for 160 keV accelerator voltage and 180 mA beam current. This strength is sufficient for radiotherapeutic use, delivering 10 rads/min at a source-to-skin distance of 89 cm. Target life-times of about 100 ohms are expected. Work is being undertaken on the addition of a second similar ion source so that the neutron output can be doubled. (UK)

28429 CAMAC SERIAL CRATE CONTROLLER. Barsotti, E. (National Accelerator Lab., Batavia, IL). CAMAC Bull.; No. 6, 9-10(Mar 1973).

The National Accelerator Laboratory uses serial CAMAC systems to control experimental beam lines, including the two-mile-long neutrino beam line. A crate controller used on a serial branch highway is described and compared with an earlier scheme based on serial links to remote drivers for parallel branch highways. (UK)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 28657 and 28745.

28430 INVESTIGATION OF DEPTH INTENSITY CURVE OF NUCLEAR EVENTS INDUCED BY MUONS. Bezrukov, L. B.; Beresnev, V. I.; Zatsepin, G. T.; Ryazhskaya, O. G.; Stepanets, L. N. (Inst. of Nuclear Research, Moscow). Yadern. Fiz.; 17: No. 1, 98-103(Jan 1973). (In Russian).

A study of depth-intensity curve of neutrons produced by muons is described. The experiment was performed in a salt mine at a depth of 316 m.w.e. underground and in a gypsum mine at a depth of 25 m.w.e. It was obtained that the number of neutrons produced by fast muons normalized to one muon, increases as $\bar{E}_{\mu}^{0.7}$ where $\bar{E}_{\mu}$ is average muon energy at a depth x. This depth-intensity curve of neutrons produced by muons agrees with theoretical curve which was obtained in consideration of development of nuclear cascades. (auth)

28431 HIGH ENERGY ASTRONOMY. Friedman, H. (Naval Research Lab., Washington, DC). Astronaut. Aeronaut.; 11: No. 4, 30-42(Apr 1973).

The field of high-energy astronomy is fairly extensively reviewed in terms of x-ray astronomy, supernovae, neutron stars, Sco X-1, x-ray sources in binary systems, extragalactic sources, diffuse x rays, very soft x-ray background, clusters of galaxies, and matter and antimatter. (WDM)

28432 STATISTICAL ANALYSIS OF FORBUSH DECREASES AND OF COSMIC-RAY INTENSITY INCREASES PRECEDING THEM. Kus'micheva, A. E.; Dorman, L. I.; Kaminer, N. S. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 525-528(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 593-597(1972).

Forbush decreases and increases preceding them are investigated from observations by the global network of neutron monitor, solar and geomagnetic activity stations for the period 1957–1969. The correlation of the amplitudes of the increases with Forbush decreases and with several geophysical and space physics parameters is analyzed. (auth)

28433 EAST–WEST ASYMMETRY OF COSMIC RAYS AT SEA LEVEL AT GEOMAGNETIC LATITUDES FROM 50°N TO 20°S. Dorman, L. I.; Chernov, S. B. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 529-532(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 598-602(1972).

The distribution of cutoff rigidities for nonvertical directions at geomagnetic latitudes 50°N to 20°S is investigated from the measured planetary distribution of the east–west asymmetry of cosmic rays. The results of the measurements are compared with theoretical computations. (auth)

28434 VARIATION OF THE COSMIC-RAY GRADIENT DURING THE SOLAR-ACTIVITY CYCLE. Lavrukhina, A. K.; Ustinova, G. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 647-648(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 744-745(1972).

An analysis of the activity of cosmogenic isotopes in meteorites that fell in different years of the solar cycle suggests that beyond the Earth's orbit there is an effective modulating layer of magnetic solar-wind inhomogeneities that reduces galactic cosmic-ray intensity by a factor of 1.65 over the cycle. The parameters of the layer are discussed. Calculations are made of average galactic cosmic-ray gradients near the Earth and greatly exceed the gradients measured from space vehicles near Earth (to a distance of 1.5 AU from the Sun), mainly during a solar activity minimum. But the differences can be eliminated if certain variations in the thicknesses of the effective modulating layer during the solar activity cycle are assumed. It is concluded that the main contradiction to diffusion theory is removed, which in the framework of the small gradient measured near Earth, is incapable of explaining the close position of the upper boundary of the effective modulation region derived from a combination of observed phenomena. (JCW)

28435 COSMIC-RAY PARTICLE DENSITY. Jatczak, J. Postepy Astronaut.; 6: No. 1, 5-21(1972). (In Polish).

The determination of particle density in an extensive air shower of cosmic radiation is described, and an equation is derived for calculating the most probable logarithmic particle density. Logarithmic particle density values are calculated as a function (1) of the number of triggered detectors and (2) of the exponent (gamma) of the shower density spectrum. (IAA)

28436 RADIOACTIVITY OF THE TILLABERI METEORITE (APRIL 25TH, 1970) MEASURED BY γ-RAY SPECTROMETRY. Tobailem, J.; Nordemann, D.; Lalou, C. (CEN de Saclay, Gif-sur-Yvette, France). Compt. Rend., Ser. B; 276: No. 1, 59-61 (3 Jan 1973). (In French).

The activities of the ^{54}Mn, ^{22}Na, ^{60}Co, ^{26}AL, and ^{40}K radionuclides in a 0.146 kg fragment of the Tillaberi stone meteorite which fell the 25th of April 1970, were measured using low background spectrometry. The results obtained are discussed. (FR)

28437 INTRODUCTION TO THE PHYSICS OF COSMIC RADIATION. Volume 2. Low Energy Physics. Dupuy, J. E. Paris; Doin (1972). 353p. (In French).

The following problems are considered: cosmic radiation (primary and secondary); its interaction with the atmosphere and the Earth's magnetic field; the astrophysics of cosmic rays; nuclear interactions occurring at very high energy; solar cosmic rays. (FR)

Stars

Refer also to abstracts 28729 and 28920.

28438 NEW AGE INDICATOR FOR GALACTIC CLUSTERS. Taff, L. G.; Littleton, J. E. (Univ. of Rochester, NY). Astrophys. Lett.; 13: No. 3, 133-135(Mar 1973).

The correlation of the color index of the second bluest star in galactic clusters was investigated with two quantitative and one qualitative method for determining relative ages of galactic clusters. The results support the conclusion that this color index is a monotonic function of the age of the cluster. (auth)

28439 HELIUM CONTENT OF 88 HERCULIS. Spite, M. (European Southern Observatory, Santiago de Chile). Astrophys. Lett.; 13: No. 3, 137-138(Mar 1973).

The helium content of the metal-deficient star 99 Herculis was estimated, first by use of the mass–luminosity relation, and second from the comparison between the spectroscopic gravity and the gravity deduced from the mass of the star. Both cases yielded a helium abundance higher than the Sun's. The inaccuracy of the data does not assure that this high helium abundance is real, but at least it can be said that helium is not deficient in this star. (auth)

28440 PHOTOELECTRIC PHOTOMETRY OF NGC 7027. Schwartz, R. D. (Univ. of Washington, Seattle); Peimbert, M. Astrophys. Lett.; 13: No. 3, 157-160(Mar 1973).

From new infrared observations the reddening of NGC 7027 is obtained. By comparison with observations in the blue and the radio region small differences with respect to the normal reddening law are derived, and possible causes for these differences are discussed. The auroral lines of [NI] are detected for the first time in this object. (auth)

28441 ASTROPHYSICAL ASPECTS OF HIGHLY-COLLAPSED STARS. Pacini, F. (Laboratorio Astrofisica Spaziale, Frascati, Italy). Riv. Nuovo Cim.; 2: No. 4, 498-507(1972).

The basic mechanism involved in the Crab Nebula appears to be deceptively simple: an object with net angular momentum collapses, the gravitational energy is converted into rotational energy, the rotation coupled to strong magnetic fields gives rise to large scale, strong, electromagnetic fields. In one way or another, these fields are capable of accelerating particles and of creating a system of relativistic currents: these currents create large-scale magnetic fields which interact with the high-energy electrons and cause a conspicuous flux of nonthermal electromagnetic radiation. (WDM)

28442 GRAVITATIONAL COLLAPSE AND BLACK HOLES. Ryder, L. (Kent Univ., Canterbury, Eng.). Phys. Educ.; 8: No. 2, 86-91(Mar 1973).

A brief survey is given of what happens to a star when it dies. The theories predict supernovae, white dwarf stars, neutron stars, and black holes. The first two are now relatively familiar astronomical objects. In 1968 pulsars were discovered, and these are now believed to be rotating neutron stars. This gave an impetus to investigate black holes, the strangest and most exotic of the predictions, more fully, and a fairly clear picture is now beginning to emerge. A brief outline is given of gravitational collapse and the occurrence of a supernova, and then black holes are described. (auth)

28443 SUPERIMPOSITION OF POLOIDAL MAGNETIC MULTIPOLE FIELDS IN NEUTRON STARS. Dautcourt, G.; Fritze, K. (Zentralinstitut fuer Astrophysik, Postdam, Ger.). Monatsber. Deut. Akad. Wiss. Berlin; 13: No. 10-12, 749-753(1971). (In German).

It is demonstrated that superimposition of poloidal magnetic fields alone cannot occur generally in fluid, conductive, and nonviscous matter of neutron stars with barytropic state equation. To obtain an equilibrium configuration, toroidal field components, too, are necessary. (tr-auth)

28444 HYDRODYNAMICS OF STAR CLUSTERS WITH SPHERICAL SYMMETRY. Talpaert, Y.; Lefevre, F. (Ateliers de Constructions Electriques, Charleroi, Belg.). Bull. Cl. Sci., Acad. Roy. Belg.; 58: No. 6, 759-774(1972). (In French).

A fluid-dynamical method for computing the evolution of a spherical cluster is developed with the help of the spectral equation. The so obtained partial derivatives system is closed by introducing a "coefficient d'échange de tensions" expressing the manner by which a fifth order tensions flux influences the fourth order tensions. By this technique, every moment of the velocity distribution up to the fourth order is included contrary to Larson's method with a nearly Maxwellian velocity distribution. Moreover the use of the equation giving the energy flux variation in the radial direction is straightforward. The "collision terms" are evaluated by the Fokker–Planck equation using Larson's technique. The partial derivatives system is replaced by a system of finite difference equations. (auth)

28445 BLACK HOLES: DISAPPEARING STARS. de Closets, F. Sci. Avenir; No. 312, 170-175(Feb 1973). (In French).

A brief survey is presented of the different stages involved in the evolution of cosmic matter under the influence of gravitational forces: aspiration and concentration of the cosmic cloud, agglomeration in the form of a planet or star, and the birth of black holes after having passed through the intermediate stages of white dwarfs, neutron stars, and collapsars. Black holes, which are produced by the gravitational collapse of very big stars trap light and constitute singularities disobeying the laws of physics. Definite proof of their existence is not yet available. (FR)

28446 POTENTIAL TENSOR OF THE GRAVITATIONAL FIELD OF A SUPERNOVA. Canales del Olmo, O. Mexico City; Universidad Nacional Autonoma de Mexico (1972). 310p. (In Spanish).

Thesis.

The gravitational field of a supernova during explosion consists of three parts: field of the residual star, field of the radiant energy, and field of the ejected material. The field of the ejected material is analyzed in the present study. The gravitational field of a spherical shell in expansion with constant radial velocity and magnitude of density decreasing with respect to the radius is first calculated. The universe line bundle of the mass elements of the shell form the ejection cone in time–space. In order to obtain the gravitational effect of the shell in an event of the field it is necessary to integrate the effects which occur at the point of the field at a fixed moment and which proceed from the mass elements of the spherical shell. Therefore the light cone with vertex in the event of the field was constructed. The gravitational effects of the mass elements travel the length of the generatrices of this cone. The intersection of the ejection cone with the light cone represents the positions in time space of the mass elements of the spherical shell in expansion, which corresponds to the start of the gravitational effects which occur in the event of the field. The gravitational potential tensor of the spherical shell in expansion is the differential element of the tensor corresponding to a body limited by two concentric spheres at finite distance which both move with equal radial velocity. The gravitational field of this body is necessary to calculate the gravitational phenomena around the explosion of a supernova. The gravitational potential tensor of a hollow sphere of finite density in expansion with constant velocity is obtained. (tr-auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstract 27640.

28447 PHENOMENA EXPECTED FROM THE EJECTION OF PARTICLES BY THE PULSAR NP 0532 INTO THE CRAB NEBULA. Ozernoi, L. M.; Usov, V. V. (Lebedev Inst. of Physics, Moscow). Astrophys. Lett.; 13: No. 3, 151-156(Mar 1973).

The consequences are considered of the possible existence of a rather dense, quasistationary, magnetosphere around pulsar NP 0532 and of an instability of this magnetosphere appearing with the accumulation of particles. Redistribution of particles in the magnetosphere and the ejection of "superfluous" particles from it leads to pulsar spin jumps with an amplitude close to the observed one. When moving away from the pulsar, the ejected plasma disperses. Because of the interaction with the low-frequency magnetic-dipole radiation of the pulsar, the dispersed plasma will accelerate up to relativistic energies. The synchrotron radiation from the accelerated particles is calculated. The radiation maximum must be observed soon after the spin jump in the infrared region, and then gradually shifted into the millimeter region up to wavelengths of several centimeters as the plasma moves to the cavity boundary around the pulsar. (auth)

28448 INFRARED EMISSION FROM THE OH/H_2O SOURCES IN W49. Becklin, E. E. (California Inst. of Tech., Pasadena); Neugebauer, G.; Wynn-Williams, C. G. Astrophys. Lett.; 13: No. 3, 147-149(Mar 1973).

Infrared sources have been found coincident with both sources of maser emission in W49. The ratios of their 1.35-cm H_2O line to 20-μm continuum emission, however, differ by a factor of 10^3, the notoriously powerful H_2O source having comparatively weak 20-μm emission. If the OH and H_2O masers are the result of infrared pumping, there must be some absorption of the infrared energy between the masering region and the Sun. The extinction in the direction of W49 is at least 50 visual magnitudes. (auth)

28449 RADIO CONTINUUM EMISSION OF THE OH/IR-SOURCE ON-4. Baars, J. W. M. (Netherlands Foundation for Radio Astronomy, Dwingeloo); Wendker, H. J. Astrophys. Lett.; 13: No. 3, 139-141(Mar 1973).

The OH/IR-source ON-4 was observed in the continuum at 1415 MHz with the Synthesis Radio Telescope at Westerbork. The upper limit to the flux density was 1.5×10^{-29} W m^{-2} Hz^{-1}. If an optically thick compact H II region were associated with the OH source, it would have a linear size several orders of magnitude smaller than that of compact H II regions known to be related to OH sources. A weak radio source of 3.5×10^{-29} W m^{-2} Hz^{-1} is found 1.5 arc min north of ON-4. It coincides with the 10th magnitude star HD 195214. (auth)

28450 NEW OH SOURCES DISCOVERED AT 1612 MHz. Winnberg, A. (Max-Planck-Institut fuer Radioastronomie, Bonn); Goss, W. M.; Hoeglund, B.; Johansson, L. E. B. Astrophys. Lett.; 13: No. 3, 125-131(Mar 1973).

More than 30 new sources of OH emission were found at 1612 MHz with the 25-m antenna of the Onsala Space Observatory. Most of these sources are Type II OH/IR emitters. The distribution of the velocity differences between the two line components of this type of sources has a maximum at 30 km sec^{-1} and a half-width of approximately 20 km sec^{-1}. Many high-velocity emission components were seen. This is probably a reflection of the large random motions characteristic of long period variables. (auth)

28451 EVOLUTION OF THE PULSAR MAGNETOSPHERE. Endean, V. G. (Oxford Univ.). Nature (London); 241: No. 5386, 184-185(19 Jan 1973).

Before the discovery of pulsars Hoyle, Narlikar, and Wheeler reasoned that the magnetic neutron star would have a very tenuous atmosphere, but in 1969 Goldreich and Julian reached a different conclusion, and argued that the electromagnetic forces near the surface of a rotating magnetic neutron star are so large by comparison with the gravitational forces that charged particles must be pulled out of the star at a sufficient rate for a dense magnetosphere to be generated. More recent work suggests that both conclusions are likely to be right, but at different stages in the evolution of the star. The new results have an important bearing on the evolution of the pulsar magnetosphere, and a classification of the different stages of evolution based directly on observational evidence has been given, and a theoretical classification of the different possible types of pulsar rotating field has also been worked out. The author interprets the observational results in the light of the theoretical results in order to obtain more insight into the evolution of the pulsar magnetosphere. (UK)

28452 UNKNOWN X-RAY SOURCES. Ilovaisky, S. D. Sci. Progr. Decouverte; No. 3450, 12-18(Dec 1972). (In French).

The Uhuru satellite enabled accurate determination to be made of the positions of already known cosmic x-ray sources together with those of about 40 new sources near the galactic plane and an equal number of new sources outside the galactic plane. The satellite enabled a more detailed study of the behavior of certain of these sources to be made: pulsed radiations, eclipses of binary sources; identification with visible stars. (FR)

Solar Phenomena

Refer also to abstracts 28533 and 28557.

28453 ENERGY FLUX INTO THE SOLAR CHROMOSPHERE FROM THE FIVE-MINUTE OSCILLATION. Zhugzhda, Yu. D. (Lab. of Solar Activity, Moscow). Astrophys. Lett.; 13: No. 3, 173-176(Mar 1973).

The formula for the energy flux of nonadiabatic oscillations in an inhomogeneous atmosphere is deduced. The energy flux of 300-sec oscillations at the 450 km level is estimated. In the case of a horizontal wavelength of 3×10^3 km the flux is sufficient to heat the solar atmosphere. (auth)

28454 HELIUM ABUNDANCE OF THE SUN. Hirshberg, J. (Ames Research Center, Moffett Field, CA). Rev. Geophys. Space Phys.; 11: No. 1, 115-131(Feb 1973).

The solar abundance of helium (more specifically, the ratio of solar helium to hydrogen) is a basic quantity in understanding many astrophysical and space physical problems. Four methods have been used to estimate the ratio of helium to hydrogen; the solar neutrino flux, spectral intensity of helium lines in prominences and the chromosphere, elemental abundance of solar cosmic rays, and variations of solar wind He/H. At present the measured value for the neutrino flux cannot be explained by any of the theoretical models of the Sun, and thus the neutrino measurements cannot yield an estimate of He/H. Helium line intensity measurements give the most accurate values for He/H now available, i.e., 5 to 8% helium by number. These results refer to the chromosphere and prominences only, and questions of spatial and temporal variations of the observed quantities and of the inferred helium abundances have not yet been dealt with adequately. The cosmic-ray observations are usually interpreted as indicating 6% helium at the flare site. However, this interpretation is here called into question because of an apparent energy dependence of the observations. The variations of He/H in the solar wind yield information on the coronal distribution of helium, rather than the solar abundance. The solar-wind observations are most easily interpreted in terms of a moderate helium enhancement (He/H ~ 10 to 15%) in the deeper levels of the solar atmosphere, but a uniformly mixed corona cannot at present be completely ruled out. It is concluded that the solar abundance of helium remains uncertain to within a factor of 2 or 3. (47 references) (auth)

28455 THEORETICAL STUDY OF THE FRAUNHOFER LINES POLARIZATION: THE CASE OF Ca I 4227. Dumont, S. (Institut d'Astrophysique, Paris); Omont, A.; Pecker, J. C. Solar Phys.; 28: No. 2, 271-288(Feb 1973).

The measurements by Brückner (1963) of the Ca I 4227 polarization at the Sun's limb provides a test for the theory of line polarization. Computations are developed taking into account: (a) the transfer polarization, due to the anisotropy of radiation field; (b) the depolarizing collisions acting in the wings. The magnetic field is not taken into account and the theory is not valid in the Doppler core. In the wings a very good fit is obtained, using appropriate source-functions fitting the observed profiles at the center of the disk, and from center to limb. (auth)

28456 HIGH-RESOLUTION ULTRAVIOLET SOLAR SPECTRA IN THE REGION 2765 TO 2822 Å. Greve, A.; McKeith, C. D.; McKeith, N. E. (Queen's Univ., Belfast). Solar Phys.; 28: No. 2, 289-309(Feb 1973).

Wavelengths and identifications of the near ultraviolet solar spectrum are presented. The data were obtained during the rocket flight of an interferometer spectrograph with a spatial resolution of 0.03 Å. (auth)

28457 BRIGHTNESS FLUCTUATIONS IN THE K-LINE WINGS. Cha, M. Y.; Orrall, F. Q. (Univ. of Hawaii, Honolulu). Solar Phys.; 28: No. 2, 333-341(Feb 1973).

A power-spectrum and cross-spectrum analysis was made of measurements of temporal fluctuations of intensity observed in the K-line wing (2.07 Å from line center) and of simultaneous measurements of temporal fluctuations of Doppler displacement of the cores of λ3931.122 Fe I and λ3933 Ca II (K_3). The measurements were made in a quiet region near the center of the Sun's disk. It was found that the average power spectra of the intensity fluctuations had two significant peaks of about equal strength: one at 0.0033 Hz (300-s period); and one at about 0.0001 Hz (1000-s period). The average rms value of these intensity fluctuations was 0.0435 ± 0.0082. Maximum brightness came before maximum violet displacement of the Fe I line. The mean of the best determined phases was 137° and of all the data 108°. At those places on the Sun where the 300-s oscillations can be identified in the K_3 core, the Doppler displacement of the Fe I line lead that of K_3 core by a mean phase angle of 27°. (auth)

28458 EQUATOR–POLE TEMPERATURE DIFFERENCE AND THE SOLAR OBLATENESS. Noyes, R. W. (Smithsonian Astrophysical Observatory, Cambridge, MA); Ayres, T. R.; Hall, D. N. B. Solar Phys.; 28: No. 2, 343-345(Feb 1973).

Model calculations were carried out to determine the change in equivalent width of CO lines near the limb caused by introducing a depth-independent temperature perturbation ΔT into the HSRA model above the level $\tau_{5000} = \tau_0$. (WDM)

28459 SOLAR TEMPERATURE DISTRIBUTION WITH LATITUDE. Rutten, R. J. (Astronomical Inst., Utrecht). Solar Phys.; 28: No. 2, 347-349(Feb 1973).

To search for a pole–equator temperature asymmetry in higher layers of the photosphere, the Mg I λ4541.1 intercombination line was observed at various positions on the solar disk. (WDM)

28460 SUNSPOT OBSERVATIONS BY MEANS OF A VIDICON CAMERA. I. Matsumaru, K. (Defense Academy, Yokosuka, Japan). Solar Phys.; 28: No. 2, 351-360(Feb 1973).

In an electronic method, the circular sunspots are recorded on a magnetic video tape recorder, and then the recorded images of them are reproduced on a picture monitor and the video signals are simultaneously displayed on an oscilloscope. By means of a line selector, the waveform of a single scanning line of the total raster may be photographed immediately. From these successive waveforms one may directly calculate the relative brightness from the ratio of the voltage of the spot to that of the photosphere and the brightness gradient over the whole spot area. Usually one can get all these results of an individual spot within two or three days. As typical examples, five circular spots of medium scale were selected from many recorded data and their characteristics explained. More accurate results can be obtained if a standard image orthicon camera is used. The new method may be effective if applied to a large telescope, and also it may be valid for several spectroscopic observations. (auth)

28461 CHARACTERISTICS OF UMBRAL FINE STRUCTURE. Kneer, F. (Fraunhofer Institut, Freiburg i. B.). Solar Phys.; 28: No. 2, 361-367(Feb 1973).

Photographic spectra of the umbra of a sunspot (August 24, 1971, Rome No. 6205) around 6150 Å show fine bright threads which were identified as the spectra of a lightbridge, of the bright end of a penumbral filament and of umbral dots, respectively. It was found, in agreement with the results of other authors, that the magnetic field in bright structures is considerably weaker than in dark umbral material. Analysis of line profiles of Fe II 6149.2 Å in umbral dots indicates (a) a fieldstrength reduced by a factor ≈2 compared to the surroundings, (b) an outflow with $v \approx 3.0$ km s^{-1} relative to the penumbra, and (c) possibly photospheric temperatures in umbral dots. (auth)

28462 WIDTH OF EMISSION CORES OF THE LINE K Ca II IN SUNSPOTS. Teplitskaya, R. E.; Efendieva, S. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Irkutsk, USSR). Solar Phys.; 28: No. 2, 369-375(Feb 1973).

Emission core widths of K Ca II line in the umbra and penumbra of 9 sunspots and in their vicinity were measured. All sunspots were located near the solar disk center. Data on variation of widths W_k along the 'mean' sunspot radius were obtained. Values W_k in the umbra and penumbra centers were equal or somewhat less than on stars of the same luminosity. (auth)

28463 FILTER OBSERVATIONS OF PROMINENCES IN THE D_3 AND Hα LINES. Kim, I. S.; Nikolskii, G. M. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Solar Phys.; 28: No. 2, 377-388(Feb 1973).

D_3 and Hα pictures of prominences were obtained with a 21-in. Lyot coronograph and a Fabry–Perot etalon used as a narrow band filter. The monochromatic images of quiescent, 'quasi-quiescent' and loop-prominences were studied. The comparison of the isophotes of quiescent and 'quasi-quiescent' prominences in D_3 with those in Hα shows the similarity of the prominence structure at both wavelength, although there is a strong tendency for an increase in the intensity ratio D_3/Hα in the upper region of prominences. It seems that it is due to lower temperature in the upper regions of prominences. Probably, the relaxation processes establishing ionization equilibrium play some role. Measurements of the knot intensities of the loop-prominence show strong variations of the intensity ratio D_3/Hα (more than one order of magnitude). (auth)

28464 SECONDARY POLAR ZONE OF SOLAR PROMINENCES. Waldmeier, M. (Swiss Federal Observatory, Zurich). Solar Phys.; 28: No. 2, 389-398(Feb 1973).

The polar prominences are concentrated in a zone, which in the period between sunspot minimum and maximum is shifted about 45° heliographic latitude towards the pole. Cycle No. 20 has shown an anomaly never observed before, as on the northern hemisphere two zones of polar prominences were formed, the second zone following the first one at an interval of 2.5 yrs. The activity in the polar zone in closely connected with that in the main zone. This connection is much tighter than for instance the one between the northern and the southern hemisphere. The question was investigated whether the anomalous appearance of a second polar zone might be related to a corresponding anomaly in the main zone. Such an irregularity exists in the latitude variation in the main zone. Such an irregularity exists in the latitude variation of the sunspots. After a regular decrease in heliographic latitude up to mid-1969, the northern sunspot zone suddenly shifted by 2.5° towards higher latitudes in the second half of 1969. This jump of the spot zone coincides with the appearance of the secondary polar zone of prominences. (auth)

28465 LOW INTENSITY Hα EMISSION OBSERVED BY J.-L. LEROY IN THE SOLAR CORONA. Oehman, Y. (Stockholm Observatory, Saltsjoebaden, Sweden). Solar Phys.; 28: No. 2, 399-402(Feb 1973).

Some comments are presented on the important observations of faint prominences made recently by Leroy at the Pic du Midi Observatory. The writer draws attention to the very probable connection with faintly luminous Hα obscuring prominences which appear sometimes as dark lanes and markings in ordinary prominences. (auth)

28466 ENERGY BUDGET IN CORONAL HOLES. Noci, G. (Harvard Coll. Observatory, Cambridge, MA). Solar Phys.; 28: No. 2, 403-407(Feb 1973).

It is shown that the constancy of the ratio between conductive flux and pressure squared as one goes from quiet regions to 'holes' (regions of exceptionally low density and temperature) in the solar corona, observed in the case of the first well-studied coronal hole, implies that a strong solar wind is likely to originate in coronal holes. (auth)

28467 RECALIBRATION OF THE QUIET SUN MILLIMETER SPECTRUM BASED ON THE MOON AS AN ABSOLUTE RADIOMETRIC STANDARD. Linsky, J. L. (Univ. of Colorado, Boulder). Solar Phys.; 28: No. 2, 409-418(Feb 1973).

The solar millimeter continuum between 1 and 20 mm is recalibrated using observations of the average lunar brightness temperature at the center of the lunar disk and new Moon brightness temperatures. The solar data are placed on a common scale according to the average lunar brightness temperature distribution proposed by Linsky. A least-squares parabolic regression curve is proposed for the solar millimeter continuum. A small departure from this regression curve near 8 mm may indicate the existence of an absorption feature. (auth)

28468 FURTHER EVIDENCE FOR A COMPLEX LIMB STRUCTURE IN THE SOLAR RADIAL BRIGHTNESS DISTRIBUTION AT MM WAVELENGTHS. Swanson, P. N.; Wefer, F. L.; Decker, W. J.; Hagen, J. P. (Pennsylvania State Univ., University Park). Solar Phys.; 28: No. 2, 419-424(Feb 1973).

A computer program to convolve numerically any azimuthally symmetric, solar radial brightness distribution with standard antenna patterns of small half-power beamwidths was used to find a solar brightness distribution which is a good fit to the eclipse curve obtained during the March 7, 1970 partial solar eclipse with the NRAO 36-ft antenna at 3.5 mm. This brightness distribution was compared with the brightness distribution at 3.2 mm determined by the Pennsylvania State University Radio Astronomy Observatory group during the same eclipse but observed from Mexico where totality occurred. The two brightness distributions were very similar in shape, showing a double peak near the limb, but differing slightly in the positions of the peaks. (auth)

28469 HEIGHT OF 9.1 CM SOLAR EMISSION FROM LATITUDE SHIFT. Graf, W.; Bracewell, R. N. (Stanford Univ., CA). Solar Phys.; 28: No. 2, 425-433(Feb 1973).

Active regions that are sources of microwave solar emission should appear displaced in latitude relative to the associated optical feature and from this displacement it should be possible to deduce the height. Although the displacement is only about one-third of a min of arc at the most, it was found possible, in an investigation based on 1264 cases in 1970, to obtain a height with precision as good as or better than has generally been achieved in previous studies based on the rate of motion in longitude. This success could be due to the possibility of using large quantities of data or to tolerance of the method to both terrestrial atmospheric refraction and proper motion in heliographic longitude. The result obtained for 1970 was 18000 ± 5000 km (standard deviation). Application of the latitude method at other wavelengths would be desirable. (auth)

28470 IMPROVED THREE-DIMENSIONAL MAPPING OF THE ELECTRON DENSITY DISTRIBUTION OF THE SOLAR CORONA. Perry, R. M.; Altschuler, M. D. (National Center for Atmospheric Research, Boulder, CO). Solar Phys.; 28: No. 2, 435-456(Feb 1973).

Three-dimensional maps of the distribution of coronal electron density can now be computed with two radial functions in the series expansion for the density (rather than with only one radial function as shown in a previous paper). With the improved maps one can determine the topological variation of the electron density with radial distance, and thus can (1) distinguish coronal condensations from coronal streamers, (2) trace the structure of a streamer as a function of height, and (3) determine the nonradial orientation of a streamer. The previous work is summarized in concise mathematical notation, examples are shown of improved maps derived from two radial functions, and the expectations and limitations of the method are discussed in detail. Of great utility are computer-simulated pictures showing the solar corona as it would appear if viewed from above the north (or south) pole. (auth)

28471 ALLER'S ADMIXTURE RADIATION EFFECT DURING THE COMPRESSION PROCESS IN THE SOLAR CORONA AND GENERATION OF CORONAL FORMATIONS. Guseinov, R. E. (Astrophysical Observatory, Baku). Solar Phys.; 28: No. 2, 457-463(Feb 1973).

The cooling due to Aller's admixture radiation in the energy balance equation describing the coronal gas condensation is taken into account. It is shown that the compression mechanism does not apply for the explanation of the quiescent prominences formation but is quite suitable for definite kinds of active prominences and flares of coronal origin. Two possible variants of magnetic field before and in the process of compression within the coronal element and beyond it are considered. (auth)

28472 ANOMALOUS POLARIZATION OF THE CORONA. Molodenskii, M. M. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Solar Phys.; 28: No. 2, 465-475(Feb 1973).

At present data exist showing that in some regions of the corona the polarization degree has been found to be higher that the maximum possible value determined by Thomson scattering. Besides this, there exist regions where the direction of the prevailing vibration of the E-vector does not coincide with the tangential one. This may be caused by the velocity of scattered electrons. The theory of polarization taking the velocity into account is given, and the above-mentioned data are discussed. The direction of polarization turns out to be the sensitive detector of fast electrons (for energy of 5 keV, the deviation angle ≈10°). Very important data about accelerated electrons on the Sun may be received from precise measurements of the corona polarization. (auth)

28473 DYNAMICS AND LOCALIZATION OF SURGES IN THE CHROMOSPHERE. Platov, Yu. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Solar Phys.; 28: No. 2, 477-485(Feb 1973).

The dynamics of small surges has been studied using filter and spectral observations in the Hα line. The surge evolution allows the division into two stages which follows from the observational results. The first stage includes an abrupt Hα line broadening and the upward acceleration of the surge material. The second one is the inertial motion of the surge plasma along the magnetic force lines. Surges are probably produced by the plasma raking-up which is connected with the growth of the local magnetic field. (auth)

28474 INVESTIGATION OF THE STRUCTURE OF CORONAL ACTIVE REGIONS. Parkinson, J. H. (Univ. of Leicester, Eng.). Solar Phys.; 28: No. 2, 487-493(Feb 1973).

The temperature and density structure of a 'typical' coronal active region is deduced from x-ray observations of several active regions. Observations of the limb transits of three regions from OSO-5 indicate that the x-ray emission originates between 2×10^4 km and 1.5×10^5 km. An emission measure–temperature distribution is deduced from high-resolution x-ray spectra obtained with a rocket observation of two similar regions. These observations are combined to give a model of a 'typical' active region, the temperature varying from 2 to 6×10^6 K with corresponding densities between 2×10^9 and 10^{10} cms^{-3}. (auth)

28475 FLARE-PRODUCED CORONAL MHD-FAST-MODE WAVEFRONTS AND MORETON'S WAVE PHENOMENON.

Uchida, Y. (Tokyo Astronomical Observatory); Altschuler, M. D.; Newkirk, G. Jr. Solar Phys.; 28: No. 2, 495-516(Feb 1973).

The propogation characteristics of MHD fast-mode disturbances, which can emanate from flare regions, are computed for realistic conditions of the solar corona at the times of particular flares. The path of a fast-mode disturbance is determined by the large-scale (global) coronal distributions of magnetic field and density, and can be computed by a general raytracing procedure (eikonal equation) adapted to MHD. The coronal (electron) density distribution calculated from daily K-coronameter data is used, and the coronal magnetic field calculated under the current-free approximation from magnetograph measurements of the photospheric magnetic field. The path and time-development of an MHD fast-mode wavefront emitted from the flare region (as calculated from a realistic model corona for the day of the observed Moreton wave event) are compared with actual observations of the Moreton wave event, and it is found that the Moreton wave can be identified with the rapidly moving intersection of the coronal fast-mode wavefront and the chromosphere (as hypothesized on a previous paper); the directivity (anisotropic propagation), as well as other characteristics of the propagation of the Moreton wave can be successfully explained. (auth)

28476 CHARACTERISTICS OF ELECTRON AND HIGH-ENERGY PROTON FLARES. Sarris, E. T.; Shawhan, S. D. (Univ. of Iowa, Iowa City). Solar Phys.; 28: No. 2, 519-532 (Feb 1973).

High-energy proton ($E_p > 55$ MeV) and electron ($E_e > 50$ keV) events were observed by University of Iowa experiments on the satellites Explorer 33 and 35. The solar x-ray (2 to 12 Å) flares associated with the energetic proton events were found to have in general higher peak fluxes, considerably longer decay times (Δt), and smaller rise to decay time ratios (r) than the x-ray flares associated with the electron events. The most common decay times and rise to decay time ratios were: $80 \leq \Delta t \leq 100$ min, $0.1 \leq r \leq 0.2$ for the proton x-ray flares and $\Delta t \leq 20$ min, $0.3 \leq r \leq 0.7$ for the electron ones. (auth)

28477 SOLAR OUTBURST ON AUGUST 7, 1972 AT 17 GHz AND 35 GHz. Fuerst, E. (Max-Planck-Institut fuer Radioastronomie, Bonn); Hachenberg, O.; Hirth, W. Solar Phys.; 28: No. 2, 533-537(Feb 1973).

The radio burst on August 7, 1972, is discussed. On 17 GHz the peak flux was about 25,000 SFU. Considering the decreasing phase of the burst, it was found than an exponential decrease as well as a power-law decrease can be used. The magnetic field in the origin of the burst should be of the order of 1000 G, while the exponent g due to a power-law of the energy distribution is estimated to be about $g \approx 3$. The degree of circular polarization shows an increase to about 25% during the ascending phase of the burst, while in the phase of maximal radiation and during the decrease the polarization degree was small. (auth)

28478 FLARE PATROL. Falciani, R.; Rigutti, M. (Capodimonte Observatory, Naples). Solar Phys.; 28: No. 2, 539-542 (Feb 1973).

Using data from ESSA Research Laboratory bulletins an estimate of the uncertainty for the times of beginning, maximum and ending, and maximum areas of Hα flares reported during 1967 is deduced and discussed. The need for an improvement of the reliability of the solar patrol service is also indicated. (auth)

28479 SPECTRAL INVESTIGATION OF THE CHROMOSPHERE. II. The Nature of the Mottles and a Model of the Overall Structure. Grossmann-Doerth, U.; von Uexkuell, M. (Fraunhofer Institut, Freiburg i. B.). Solar Phys.; 28: No. 2, 319-332(Feb 1973).

Highly resolved Hα spectra and filtergrams obtained at the Fraunhofer Observatory on Capri were analyzed by a method whose principles have been described before. As a result of the tentative conclusion of a previous work was confirmed: The mottles of the chromospheric fine structure are clouds superimposed on the low chromosphere. Furthermore, it is proposed that the latter is identical with the interior of the supergranular cells whose spatial averages lend themselves to an interpretation in terms of a spherically symmetric model. On the other hand, evidence is presented that the boundary regions which are formed by the mottles of the fine structure pattern and which constitute the upper chromosphere are not adequately described by spatial averages. Instead, the properties of the individual structural elements should be taken into account by an appropriate theory, if only in a statistical fashion. Some of these properties, viz. source function, optical thickness, Doppler width and velocity, were measured for a large number of elements. On the basis of indirect evidence it is suggested that the spicules seen on limb photographs of chromospheric lines are identical with the elements of the supergranule boundary structure. (auth)

28480 CONTRIBUTION TO THE OBSERVATION OF THE PHOTOSPHERIC OSCILLATIONS. Fossat, E.; Ricort, G. Univ., Nice). Solar Phys.; 28: No. 2, 311-317(Feb 1973).

Observations of the 300 s photospheric oscillation on large solar surfaces (up to 5′ 20″ in diameter) using a sodium optical resonance cell seem to show that the power at long horizontal wavelengths is larger than previous results would indicate. In order to get more information about the spatial distribution of the energy, a new observational method has been perfected, which will give the spatiotemporal power spectuum. In some of the observations, a long-period oscillation (about 40 min) appears, with an amplitude comparable to that of the 300-s oscillation, and which seems to be correlated with the occurrance of chromospheric flares. (auth)

28481 SOLAR ELECTRICAL DISCHARGES. Crew, E. W. Nature (London); 241: No. 5384, 39(5 Jan 1973).

Comments are offered on the communication of Hemenway (Nature 238: 256(1972)). It is stated that the problem concerning submicron particles coming from the Sun does not arise if the white streaks that can be clearly seen in the perimeter of sunspots are electrical discharges. (UK)

Galaxies

28482 RADIO SPECTRUM OF M31. Berkhuijsen, E. M.; Wielebinski, R. (Max-Planck-Institut fuer Radioastronomie, Bonn). Astrophys. Lett.; 13: No. 3, 169-172(Mar 1973).

Observations were made of the Andromeda Nebula, M31, at 2695 MHz, beamwidth 4.8 arc min, with the 100-m radio telescope of the Max-Planck-Institut für Radioastronomie. Scans, 4° in extent, were made along the major axis of the nebula and parallel to it, 10 arc min on either side. The results show that the spectra of the spiral arms and of the nucleus of M31 are nonthermal between 408 and 2695 MHz. (auth)

28483 RAPID VARIATIONS OF Hα INTENSITY IN THE NUCLEI OF SEYFERT GALAXIES NGC 4151, 3516, 1068. Cherepashchuk, A. M. (Moscow State Univ.); Lyutyi, V. M. Astrophys. Lett.; 13: No. 3, 165-168(Mar 1973).

Rapid variations of the intensity of the emission lines Hα + [N II] in the spectra of the nuclei of Seyfert galaxies NGC 1068, 3516, and 4151 were discovered. The time scale of these rapid variations was ~5 to 15 days and the amplitude was about 10 to 35%. The variations of Hα-line intensity take place with a time delay of 15 to 30 days relative to the continuum variations and are similar in form to the continuum variations. (auth)

28484 INSTABILITY OF THE DOUBLE SYSTEMS OF GALAXIES NGC 7752-53. Bertola, F.; D'Odorico, S. (Univ., Padua). Astrophys. Lett.; 13: No. 3, 161-164(Mar 1973).

The rotation curve of NGC 7753, the main component of an M51-type system of galaxies, was derived. A comparison of the radial velocity of the companion, NGC 7752, with the velocity field in NGC 7753 leads to the conclusion that the system is not bound. (auth)

28485 NEW CORRELATION AMONG HIGH-VELOCITY CLOUDS IN THE GALAXY. Silk, J.; Siluk, R. S. (Univ. of California, Berkeley). Astrophys. Lett.; 13: No. 3, 143-145(Mar 1973).

An analysis of data for 85 high-velocity clouds with $v_r \leq -39$ km/sec in the region $102° \leq l \leq 130°$ and $0 \leq b \leq 25°$ indicates that there is a correlation between the maximum hydrogen column density of each feature and the corresponding radial velocity v_r. The result can be represented by a relation of the form $N_{H,max} = A(-v_r)^{-n} + B$, with $1 < n < 5$. No change in this correlation is apparent between intermediate-velocity ($v_r > -100$ km/sec^{-1}) and high-velocity ($v_r < -100$ km/sec^{-1}) features. However, there is a significant improvement in the correlation if one divides the high-velocity features into groups at low and high galactic latitudes: this gives a distance to the high-velocity gas of about 600 pc. (auth)

28486 DISTANCE SCALE OF THE GALAXY. Woolley, R. Proc. Roy. Inst. Gt. Brit.; 45: 33-50(1972).

A discussion is presented on distances of objects within the Galaxy, including the historical background and present day ideas. (UK)

28487 COURSE ON ASTRONOMY GIVEN BY THE FRENCH ASTRONOMICAL SOCIETY. 9. The Galaxy. Dumont, M. Astronomie; 87: 18-28(Jan 1973). (In French).

Globular clusters, nebulas, and interstellar matter were studied after first having surveyed the objects found in the vicinity of the Sun. The way in which these objects are distributed in the Galaxy is recalled. (FR)

28488 ORIGIN OF ELEMENTS. Snyder, L. E. (Univ. of Virginia, Charlottesville); Buhl, D.; Zuckerman, B. Nature (London); 242: No. 5392, 33(2 Mar 1973).

Reference is made to the report in Nature Phys. Sci. 239:81 (1972), under this title, which is stated to be misleading in the light of recent observations. The conclusion that the relative abundance of ^{13}C in the ζ Oph cloud seems to be terrestrial is quite straightforward, but it is an unwarranted assumption to extrapolate the results from ζ Oph, and other tenuous clouds, to the dense dusty regions of both the galactic centre and the Orion Nebula. Other results obtained in this field are briefly reviewed. It is concluded that radio observations promise to be the most powerful ground-based tool available for abundance ratios. (UK)

Cosmology

28489 STRICTLY GEOMETRIC INTERPRETATION OF GRAVITATION IN GENERAL RELATIVITY. Kobus, J. P. Found. Phys.; 3: No. 1, 45-51(Mar 1973).

A geometric interpretation of gravitation is given using general relativity. The law of gravitation is taken in the form $R_{44} = 0$, where R_{44} is the component of the contracted Riemann–Christoffel (Ricci) tensor representing the curvature of time. The remaining curvature components of the contracted Riemann–Christoffel tensor may or may not vanish. All that is required in addition to $R_{44} = 0$ is that the Gaussian curvature R be nowhere infinite. The condition $R_{44} = 0$ yields a nonlinear wave equation. One of the static degenerate solutions represents the gravitational field surrounding a static gravitational point singularity. It is found that for this solution, the three famous predictions of general relativity are obtained in the weak-field approximation. In addition, it is found that there is a correction to the Kepler period of revolution for an orbit. (auth)

28490 EMERGING UNIVERSE. Essays on Contemporary Astronomy. Saslaw, W. C.; Jacobs, K. C. (eds.). Charlottesville, VA; University Press of Virginia (1972). 202p. $7.95.

This book originated from a series of informal evening lectures on modern astronomy presented at the Univ. of Virginia during the spring of 1971. Each essay summarizes past knowledge and introduces an important problem in astronomy and astrophysics. (WDM)

28491 CRISIS IN ASTRONOMY. Hoyle, F. (Cambridge Univ., Eng.). Proc. Roy. Inst. Gt. Brit.; 45: 199-216(1972).

This paper is based on a Discourse whose original title was "Anomalous Redshifts." The principles of the redshift method for estimating very great astronomical distances are first outlined. What many astronomers fear, however, is that any weakening of a strict relationship between redshift and distance will place in jeopardy the whole line of reasoning on which the subject of cosmology rests, and that a well ordered system of logic will be replaced by a kind of scientific anarchy. The present author doubts this so far as galaxies are concerned, although the situation might be drastically different for QSOs. There is evidence that either some QSOs do not satisfy the visual redshift–distance relationship or that they must differ enormously in their intrinsic properties. The case of NGC 4651 is discussed. The crisis in astronomy today is whether the observational data force the conclusion that the redshift–distance relationship is discrepant in some cases, if it is then new physical ideas are needed. (UK)

28492 PUZZLE OF GALACTIC DEUTERIUM. Mitton, S. New Sci.; 57: No. 836, 537-538(8 Mar 1973).

The problems raised by the recent discovery of substantial concentrations of deuterium in the Milky Way are considered and in particular the question as to whether all the deuterium in the Universe was indeed created as previously thought within a few seconds of the Big Bang. It has been suggested elsewhere that high-energy break down or spallation reactions could take place outside the stars particularly in the products of supernova explosions and this approach is considered. (UK)

28493 EINSTEIN'S SPECIAL THEORY OF RELATIVITY. Essen, L. (National Physical Lab., Teddington, Eng.). Proc. Roy. Inst. Gt. Brit.; 45: 141-160(1972).

An examination of the theory was offered under the following headings: Introduction, Newtonian relativity; the Lorentz transformations; Einstein's theory; comparison of clocks, the clock paradox; explanation in terms of gravitation; and experimental evidence. A section is also devoted as to why the theory has been accepted, and several reasons are given on why it is important to expose the faults in the theory. (UK)

28494 FARADAY ROTATION AND ANTIMATTER IN THE UNIVERSE. Nelson, A. H. (Nagoya Univ., Japan). Nature (London); 241: No. 5386, 185-186(19 Jan 1973).

It is stated that data on the Faraday rotation of polarized radio waves from extragalactic sources have led to various interpretations. For the general case of an ambiplasma, that is, a plasma consisting of mixed matter and antimatter, and assuming that the plasma frequency is negligibly smaller than the wave frequency, an expression for the rate of Faraday rotation is given. For symmetric ambiplasma the rotation rate vanishes, and the consequences of this for the interpretation of astronomical data are considered. Reference is made to the Alfven–Kevin cosmology (Rev. Modern Phys. 37: 652 (1965)), this incorporates the principle of matter–antimatter symmetry and the situation envisaged at the present era is that there are separated cells and pure matter and pure antimatter. (UK)

28495 REMARKS ABOUT RED SHIFT. Argence, E. (Institut Franco-Allemand de Recherches, Saint-Louis, France). Compt. Rend., Ser. A; 276: No. 1, 77-80(3 Jan 1973). (In French).

Relations were established for the redshift in the framework of the affine connexion. (FR)

28496 VIRTUAL PARTICLES AS SOURCES OF THE GRAVITATIONAL FIELD. Halpern, L. (Univ., Brussels). Gen. Relativity Gravitation; 3: No. 4, 405-407(Dec 1972).

The effect of virtual electromagnetic fields in closed universes is considered in the light of recent experimental and theoretical studies carried out by a number of workers. (UK)

28497 SPIN AND TORSION MAY AVERT GRAVITATIONAL SINGULARITIES. Trautman, A. (Univ., Warsaw). Nature (London) Phys. Sci.; 242: No. 114, 7-8(5 Mar 1973).

The conjecture that the singularities of gravitational collapse and cosmology might be prevented by the direct influence of spin on the geometry of space–time, which is taken into account in the Einstein–Cartan theory of gravitation, is discussed. (UK)

28498 LAGRANGIAN PROPOSED BY PECKER, ROBERTS, AND VIGIER. Chew, H. (Clarkson Coll. of Tech., Potsdam, NY). Nature (London) Phys. Sci.; 242: No. 114, 8-9(5 Mar 1973).

Reference is made to Pecker, Roberts, and Vigier (Nature 237:227 (1972)), who proposed a phenomenonological Lagrangian to account for certain galactic redshift anomalies, and for which they proposed some experimental tests. The present author states that a more direct test comes from the rate of decay of orthopositronium into three photons. (UK)

Planetary Phenomena

Refer also to abstract 28512.

28499 OBSERVATIONS OF SATURN AT WAVELENGTHS OF 6.2, 11.1 AND 21.2 cm. Gerard, E.; Kazes, I. (Observatoire, Meudon, France). Astrophys. Lett.; 13: No. 3, 181-184(Mar 1973).

Observations of the planet Saturn were made at 6.2, 11.1, and 21.2 cm in 1970 and 1971 when the rings were wide open (inclination > 21°). The disk brightness temperature increased slowly with wavelength according to the power law $T(\lambda) \propto \lambda^{0.17 \pm 0.21}$; there is no evidence for nonthermal emission in the decimeter spectrum at the time of the observations. (auth)

28500 NEW HIGH-ENERGY COMPONENT OF JUPITER'S DECAMETRIC RADIO EMISSION. Miller, H. R. (Georgia State Univ., Atlanta); Smith, A. G. Astrophys. Lett.; 13: No. 3, 177-180 (Mar 1973).

A pulse-height analysis of the decameter-wavelength observations of Jupiter has revealed that L bursts are composed of two components. The low-energy component is well described by an exponential while the high-energy component, which exhibits a striking departure from the exponential, is found to be clearly associated with the Jovian sources A, B, and C. (auth)

28501 EVOLUTIONARY CALCULATION OF JUPITER. Grossman, A. S. (Iowa State Univ., Ames); Graboske, H.; Pollack, J.; Reynolds, R.; Summers, A. Phys. Earth Planet. Interiors; 6: No. 1-3, 91-98(Dec 1972).

A preliminary evolutionary calculation was made for a stellar object of mass 0.001 $M_\odot$ composed of pure hydrogen. The star undergoes the gravitational contraction from an initial radius of 35 times the present radius of Jupiter (R_{Jup}). The interior is assumed to be in convective equilibrium throughout the evolution. The evolution was followed for 10^9 y at which time $R = 2.8\ R_{Jup}$ and the central temperature is 18,000°K. The log of the luminosity (in units of solar luminosity) and effective temperature due to the internal energy sources are $\log L/L_\odot = -9.0$ and $\log T_c = 1.77$. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 28566 and 28568.

28502 (TRITA-EPP-72-14) IONOSPHERIC TEMPERATURE AND DENSITY MEASUREMENTS BY MEANS OF SPHERICAL DOUBLE PROBES. Fahleson, U.; Faelthammar, C. G., Pedersen, A. (Kungliga Tekniska Hogskolan, Stockholm (Sweden)). Dec 1972. 66p. Dep. NTIS (U. S. Sales Only).

Rocket-borne double probes for electric-field measurements can be intermittently operated in special, diagnostic modes involving current bias and low-impedance shunts to obtain information on the properties of the ambient ionospheric plasma along the flight path. Several such modes, and the information that they can provide, are analyzed. For example, in a low-impedance mode with asymmetric bias, the attenuation ratio (i.e., signal amplitude in this mode over the signal amplitude in the electric-field measuring mode) is, in a simple way, related to the electron temperature of the ambient plasma. The special surface coatings (Aquadag or Vitreous Carbon) normally used for electric field probes provide very homogeneous surface properties, a feature that also contributes to the reliability of the electron temperature measurements. In addition to electron temperature, the modes analyzed can be used to measure electron density and to give some information on ion temperature. (Sweden)

28503 CHARACTERISTICS OF THE ELECTRIC FIELD FAR FROM AND CLOSE TO A RADIATING ANTENNA AROUND THE LOWER HYBRID RESONANCE IN THE IONOSPHERIC PLASMA. Beghin, C. (Centre National de la Recherche Scientifique, Orleans la-Source, France); Debrie, R. J. Plasma Phys.; 8: No. 3, 287-310(Dec 1972).

From a discussion of the behavior of vlf waves propagated almost perpendicularly to the earth's magnetic field, the lower hybrid resonance (LHR) frequency is seen as a boundary between compressional Alfven waves and electrostatic sound waves. The possibility is established of using the properties of fast and slow waves in active experiments, for measuring simultaneously the LHR, the electron density, a hybrid ion-electron thermal velocity and possibly the plasma drift velocity. (auth)

28504 CYLINDRICALLY SYMMETRIC WAVES IN THE MAGNETOHYDRODYNAMIC APPROXIMATION. Woolley, M. L. J. Plasma Phys.; 8: No. 3, 331-340(Dec 1972).

The equations of motion of an ideally conducting medium, in the magnetohydrodynamic approximation, are solved exactly under the hypotheses that (i) one component of the magnetic field is constant everywhere, (ii) the magnetic and hydrodynamic pressures are in equilibrium, and (iii) the solution is invariant under a continuous group of transformations that preserves the symmetry of the uniform magnetic field. The invariants of the group of transformations form the basis for a parametric description of the full solution that describes the propagation of cylindrically symmetric magnetosonic waves in the direction of the uniform field. A number of general features of the motion are deduced, and an integral expression is given for the amplitude of the component of velocity, perpendicular to the uniform magnetic field, which undergoes potential-well oscillations. (auth)

28505 RECENT WORK ON ION–CYCLOTRON WHISTLERS. Jones, D. Ann. Geophys.; 28: No. 3, 527-540(Jul 1972).

A considerable amount of experimental and associated theoretical research has recently been concentrated on the mechanisms that affect electromagnetic waves propagating in the upper ionosphere at frequencies in the region of the local ion gyrofrequencies. It is found that both polarization reversal and mode coupling manifest themselves in the phenomena observed in this vlf range by satellite receivers. In addition, reflection of the ion-cyclotron mode at an altitude that is dependent on frequency, is also important in the case of waves propagating downwards into the ionosphere from above. Interesting new phenomena can be postulated on theoretical grounds from a detailed analysis of these effects. (FR)

28506 POSSIBILITY OF USING A QUADRUPOLAR PROBE IN THE 0 TO 1000 Hz RANGE TO MEASURE THE COLLISION FREQUENCIES OF CHARGED PARTICLES IN THE IONOSPHERE. Odero, D. (CNRS, Saint-Maur-des-Fosses, France). Ann. Geophys.; 28: No. 3, 541-574(Jul 1972). (In French).

The possibility of determining the electron and ion collision frequencies for the ionospheric plasma in the 50- to 300-km altitude range using a quadrupolar probe mounted on a rocket is studied. The probe is assumed to be oriented with its plane perpendicular to the Earth's magnetic field, and its motion with respect to the plasma is neglected. The experiment would involve measuring the transfer impedance of the probe as a function of frequency in the 50 to 1000 Hz band. From such measurements, it should be possible to determine the electron collision frequency over the altitude range considered (with the exception of the 70 to 85 km range) and the mean ion collision frequency throughout the E region, from 85 to 140 km. (FR)

28507 SOME CHARACTERISTICS OF THE IONOSPHERIC IRREGULARITIES OVER THE MAGNETIC EQUATOR DERIVED FROM SPACED FADING RECORDS. Chandra, H.; Rastogi, R. G. (Physical Research Lab., Ahmedabad, India). Ann. Geophys.; 28: No. 3, 581-588(Jul 1972).

The shape, size, and the drift of the ionospheric irregularities within the E and F regions of the ionosphere over Thumba (dip 0.6°S) for the year 1967 are described on the basis of full correlation analysis of the spaced-fading records of radio-wave echoes. The drift is found to be westward during day and eastward during night, the changeover occurring around 07 hr and around 19–20 hr and the maximum value of the drift speed being at shortly before noon and before midnight. The diffraction patterns at the ground are highly elongated, the major axis being along the N–S direction during the daytime and about 10° west of north during the nighttime. The degree of elongation is highest around midday and very low at the time of reversals of drift direction. Further, the scale size of the irregularities in the E–W direction seems to be increased during the reversal times. The E–W size of the irregularities are found to be small during the period when the elongation is high. After the evening reversal the E–W size again shows a drop that seems to be associated with the phenomenon of equatorial spread F. (FR)

28508 AFTERNOON DEPRESSION IN THE HORIZONTAL COMPONENT OF THE GEOMAGNETIC FIELD AT TRIVANDRUM. Sastri, N. S.; Jayakar, R. W. Ann. Geophys.; 28: No. 3, 589-591 (Jul 1972).

The examination of seasonal variation and lunar modulation in the occurrence of afternoon depression in the horizontal component, H, at Trivandrum in the Indian equatorial electrojet region, suggests the possibility that the counter electrojet currents responsible for the phenomenon may be situated in the same ionospheric layers as the lunar currents. (FR)

28509 IMPACT AND BREMSSTRAHLUNG PHOTOIONIZATION DUE TO PRECIPITATING ELECTRONS IN THE LOWER IONOSPHERE. Prasad, R. Y.; Singh, R. N. (Banaras Hindu Univ., India). Ann. Geophys.; 28: No. 3, 593-605(Jul 1972).

The attenuation of precipitating electrons of energy $4 < E < 100$/keV in the lower ionosphere was computed. The computed results are used to study the impact and bremsstrahlung photoionization in the lower ionosphere. It is seen that maximum impact ionization produced by the precipitating electrons of energy 4, 40, and 100 keV occurs at 109, 86, and 79 km and maximum bremsstrahlung photoionization occurs just below these heights, namely 100, 72, and 65 km, respectively. It is concluded that impact ionization is an important source of ionization in the E and lower F regions, whereas bremsstrahlung photoionization is an important source of ionization in the D region. The effect of the energy spectra of precipitating electrons on the rate of electron–ion pair production is discussed. (FR)

28510 COLLISION CROSS SECTIONS FOR ELECTRONS WITH ATMOSPHERIC SPECIES. Phelps, A. V. (Joint Inst. for Lab. Astrophysics, Boulder, CO). Ann Geophys.; 28: No. 3, 611-625 (Jul 1972).

A review is made of recent laboratory measurements concerning cross sections for the elastic and inelastic scattering of electrons by stable atmospheric species. Measurements of the energy and angular distributions of inelastically scattered electrons have yielded cross sections for excitation of the principal levels of N_2, O_2, and He and for the distribution of secondary electron energies resulting from collisional ionization of these gases. Electron-beam measurements of cross sections for the production of radiation from N_2, O_2, and N_2^+ provide data of direct applicability to calculations of auroral intensities, etc. Similar data are also obtained from measurements of electron-induced fluorescence. Swarm experiments provide cross section data for vibrational and rotational

excitation of O_2 and N_2 at electron energies below about 1 eV. Afterglow and shock tube measurements have yielded the electron energy and temperature dependence of the electron-ion recombination for a few positive ions. Theoretical calculations of the cross sections for excitation of atomic oxygen and nitrogen are particularly important since laboratory measurements are not generally available. (FR)

28511 ACTIVITIES IN SPACE RESEARCH AT THE MAX-PLANCK-INSTITUT FUER EXTRATERRESTRISCHE PHYSIK, GARCHING BEI MUENCHEN (G.F.R.). Barium and Ion Clouds. Kappler, H. M. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). Ind. At. Spatiales; 16: No. 6, 57-59 (Dec 1972).

A new experimental technique was developed to study the electric field in the magnetosphere and ionosphere from measurements of the velocity of artificial barium plasma clouds. (FR)

28512 CROSS SECTIONS FOR EMISSION OF LYMAN-ALPHA RADIATION IN COLLISIONS OF 1 TO 25 keV PROTONS AND HYDROGEN ATOMS WITH CONSTITUENTS OF PLANETARY ATMOSPHERES. Birely, J. H.; McNeal, R. J. (Aerospace Corp., El Segundo, CA). Ann. Geophys.; 28: No. 3, 627-632(Jul 1972).

Cross sections are reported for emission of Lyman-α radiation in collisions of a charge-equilibrated 1- to 25-keV hydrogen beam with N_2, O_2, CO, CO_2, NH_3, CH_4, and H_2. For each target molecule, the separate cross sections for formation of H(2P) and H(2S) in H^+ and H collisions and the fractional population of these projectiles in a charge-equilibrated beam are used to calculate the effective cross section for formation of H(2P) and H(2S). Individual contributions to the overall Lyman-α intensity due to projectile and dissociative excitation are presented for the hydrogen containing compounds. The results show that, for both projectile and dissociative excitation, collisions involving impact of fast hydrogen atoms rather than protons are the major source of Lyman-α production in an aurora. The effective projectile excitation cross sections are relatively insensitive to the identity of the target molecule for all of the gases studied except H_2. Consideration of the ratio of the effective cross sections for production of H(2P) and H(2S) and of the available data on collisional quenching of H(2S) leads to the conclusion that the major contribution to auroral Lyman-α in this energy range arises from hydrogen atoms collisionally excited to the 2P level. (FR)

28513 HEATING OF THE UPPER ATMOSPHERE DURING AURORAE AND AURORAL RAYS LENGTH. Dzyubenko, N. I. (Kiev State Univ.). Ann. Geophys.; 28: No. 3, 661-664(Jul 1972).

Auroral observations in Tixie Bay region disclose a systematic diurnal variation in the lengths of the auroral rays. In this region, the ray length decreases during the evening hours, attains the minimum at about 20 LT and then increases during the night up until the morning twilight. The main features of this variation are explained by a change in the vertical structure of the auroral atmosphere because of the additional heating during auroras. The activity of visible auroras is considered as a measure of the dissipative processes causing the heating. The required heating and cooling powers are estimated approximately. The direct heating by entering auroral particles is insufficient. The necessary heating power may be provided by Joule dissipation of the ionospheric currents, the intensity of which is closely related to the auroral activity. The necessary heat loss may be provided by macroturbulent advection, infrared radiation, and probably internal gravity waves. (FR)

28514 EARTH'S ENVIRONMENT. Delobeau, F. Paris; Presses Universitaires (1967). 163p. (In French).

Extensive studies on the following subjects are presented: the Earth in space; the Earth's magnetic field; the Earth's ionosphere; the top side ionosphere and the Van Allen belts; the Earth's environment; atmospheric perturbations; and micrometeorites. (FR)

28515 FAST METHOD TO DETERMINE THE NOSE FREQUENCY AND MINIMUM GROUP DELAY OF A WHISTLER WHEN THE CAUSATIVE SPHERIC IS UNKNOWN. Ho, D.; Bernard, L. C. (Stanford Univ., CA). J. Atmos. Terrest. Phys.; 35: No. 5, 881-887(May 1973).

Using Bernard's (J. Atmos. Terrest. Phys., 35: 871(1973)) approximation of the ducted whistlers, a fast and simple method is developed for the determination of whistler nose frequency (f_n) and travel time at the nose (t_n) when both the nose frequency and the causative spheric are not directly identifiable on whistler spectrograms. This method requires measurements of time delays at only three frequencies with respect to an arbitrary time origin, and the formulas for f_n and t_n involve only simple algebraic functions. The error for f_n is comparable to the error made in measuring f_n visually in the case of nose whistlers, and a value of $\Delta t_n/t_n$ of order 5% or less is achievable. (auth)

28516 NATURE OF SEASONAL CHANGES IN THE EFFECTS OF MAGNETIC STORMS ON MIDLATITUDE F-LAYER ELECTRON CONCENTRATION. Spurling, P. H.; Jones, K. L. (Univ. of Queensland, Brisbane). J. Atmos. Terrest. Phys.; 35: No. 5, 921-927(May 1973).

Apparent discrepancies exist between the results of various investigators concerning the nature of the seasonal variation in F-layer response to magnetic storms. It is shown that the apparent discrepancies are due to different methods of data analysis, depending on whether statistical methods or individual storm-by-storm analyses are used. An additional data analysis is performed to show that although on a statistical basis storms tend to increase F-layer electron concentration in winter and decrease it in summer, virtually all storms, irrespective of their season, produce both increasing and decreasing effects on electron concentration. This morphological result is important for the study of ionospheric processes during magnetic storms. (auth)

28517 CORRELATION BETWEEN PULSATIONS IN AURORAL LUMINOSITY VARIATIONS AND X RAYS. Soerensen, T. (Univ., Bergen); Bjordal, J.; Trefall, H.; Kvifte, G. J.; Pettersen, H. J. Atmos. Terrest. Phys.; 35: No. 5, 961-969(May 1973).

Simultaneous balloon observations of >25 keV bremsstrahlung x rays and auroral N_2^+ emissions at 4278 Å show that quasi-periodic 5 to 15 sec pulsations in the two phenomena are correlated. Cross-correlation analyses show that the x-ray variations lead the luminosity variations by 0.2 to 0.6 sec, which indicates that the modulation mechanism operates far above the ionosphere. The measurements are compatible with a location in the equatorial plane. The correlation with light seems to be limited to x-rays <50 keV. (auth)

28518 ELECTRON CONTENT OF THE SOUTHERN MIDLATITUDE IONOSPHERE, 1965-1971. Titheridge, J. E. (Univ. of Auckland, New Zealand). J. Atmos. Terrest. Phys.; 35: No. 5, 981-1001(May 1973).

The electron content of the ionosphere (I) was recorded continuously from June 1965 to August 1971, at latitudes of 34 and 42°S. The diurnal ratio (I_{max}/I_{min}) is about 3 in summer and 4 in winter, compared with 4 to 6 in the northern hemisphere and 20 at the dip equator. The electron content shows a peak near 19 hr in summer caused by upward movements. The corresponding peak in N_m is delayed to 22 hr, at solar maximum, by thermal contraction of the ionosphere. There is no seasonal anomaly at 34°S. The major anomaly is a large peak in April; at 42°S I increases by 70 per cent (and N_m by 100 per cent) in 40 days at the March equinox. Changes with solar flux S show $I \propto S - 20$ for summer day, summer night, and winter day. Winter-night values are almost constant because of a lowering of the O^+/H^+ transition height to 450 km near solar minimum. 27-day variations in I follow changes in S, with a lag of 1.0 ± 0.1 days, and give values of dI/dS about 35 per cent less than for the solar-cycle changes. Large day-to-day variations in I at periods of less than 10 days are attributed to changes in the loss rate. The per cent variation is approximately independent of season and solar activity, but increases at night in winter. (auth)

28519 TOTAL ELECTRON CONTENT MEASUREMENTS DURING VISIBLE AURORAS. Watkins, B. J.; Essex, E. A. (La Trobe Univ., Bundoora, Australia). J. Atmos. Terrest. Phys.; 35: No. 5, 1009-1013(May 1973).

The ionospheric total electron content was measured continuously from Macquarie Island (54.5°S, 150.0°E geographic) by monitoring the Faraday rotation of the polarization angle of the radio beacon from the geostationary satellite INTELSAT 2F-2. The ray path from the satellite often passes through the auroral oval during nighttime, and an association has been found between total electron content increases and auroral particle precipitation as determined from all-sky camera photographs. The results from March 31, 1970 are examined. Simultaneous all-sky camera photographs indicate a total electron content increase caused by a multiple quiet arc structure. The average electron density was calculated from electron content data in conjunction with the auroral dimensions determined from the photographs. The average electron density over a height range up to about 170 km for a multiple quiet arc structure was 3.0×10^5 cm^{-3}. The subsequent breakup and poleward expansive phase of the substorm produced a further electron content increase. (auth)

28520 ENHANCEMENT OF IONOSPHERIC TOTAL ELECTRON CONTENT IN THE SOUTHERN AURORAL ZONE ASSOCIATED WITH MAGNETOSPHERIC SUBSTORMS. Essex, E. A.; Watkins, B. J. (La Trobe Univ., Bundoora, Australia). J. Atmos. Terrest. Phys.; 35: No. 5, 1015-1018(May 1973).

The columnar total electron content (TEC) of the ionosphere has been monitored continuously from Macquarie Island in the southern auroral zone during 1970 using the Faraday rotation

technique. Many TEC increases have been noted during early morning hours. The large TEC increase that occurred on 20 May 1970 is used to illustrate the relation to magnetospheric substorms. The commencement of the TEC enhancements coincided with the occurrence of two substorms. Such TEC increases are possibly the source of large scale travelling ionospheric disturbances that have been observed at midlatitudes propagating equatorward. (auth)

28521 ENERGETIC ELECTRON PRECIPITATION AS A SOURCE OF IONIZATION IN THE NIGHT-TIME D REGION OVER THE MIDLATITUDE ROCKET RANGE, SOUTH UIST. Gough. M. P.; Collin, H. L. (Univ. of Southampton, Eng.). J. Atmos. Terrest. Phys.; 35: No. 5, 835-850(May 1973).

Two Petrel rockets were launched from South Uist, Scotland, one at a magnetically quiet time and the other during a magnetic storm. At the quiet time only low precipitation fluxes ~4 electrons cm^{-2} $ster^{-1}$ sec^{-1} >40 keV were observed while during the storm these fluxes rose to as high as 3×10^5 electrons cm^{-2} $ster^{-1}$ sec^{-1} >40 keV. These precipitating energetic fluxes produced <25% of the total nighttime D-region ionization at the magnetic quiet time but the storm-time precipitation accounted for 99% of the total ionization. A clear correlation is found between particle flux and magnetic activity K_p summed over 24 hr for 13 rockets launched from South Uist. This is used with the abundance of the different levels of activity to show that precipitating energetic electrons become a dominant source of the nighttime D region on 15 ± 11% of the nights at solar minimum rising to 35 ± 20% of the nights at solar maximum. When the magnetic-field line passing through South Uist lies inside the plasmasphere, the electron precipitation continues up to 3½ days after magnetic storms in agreement with measured trapping lifetimes in the "electron slot" of the trapping region. (auth)

28522 EFFECT OF GEOMAGNETIC ACTIVITY ON OCCURRENCE OF WHISTLER ATMOSPHERICS. Ralchovski, T. M. (Geophysical Inst., Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 12, 1629-1632(1972).

Correlations were studied between the whistler occurrence and changes in geomagnetic activity. Observations were made at middle-latitudinal stations of Sofia and Panska Ves in Czechoslovakia for Sept. 1970 to Aug. 1971. Results show that at $K_p > 4$ for Sofia and $K_p > 5$ for Panska Ves none or very few atmospherics are observed. At $K_p > 4$ low-frequency emissions are observed in Panska Ves and, at that, more often in the period of equinox. In Sofia, no whistlers and emissions are recorded for $K_p > 5$. The whistlers are more frequent and, as a rule, are few when K_p remains relatively constant during the entire 24 hours. Whistlers are almost always observed at night when the magnetic conditions change suddenly. (JCW)

28523 SEASONAL PATTERN OF $S_q(H)$ VARIATIONS AT MIDDLE LATITUDES IN DIFFERENT HOURS OF THE DAY. Pogrebnoi, V. N. (Ionospheric Sector, Kazakh, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 674-675(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 771-772(1972).

Results are reported of an analysis of the seasonal pattern of the absolute level of the H component of the magnetic field for all hours of local days from the data of Alma-Ata and Rude Skov observatories over the periods 1963 to 1970 and 1910 to 1962. The S_q variations are produced by ionospheric currents flowing at heights of 100 to 120 km and the seasonal pattern of $S_q(H)$ variations can be explained by the reinforcement of these currents during the transition from local winter to local summer. (JCW)

28524 ANALYSIS OF STABLE GEOMAGNETIC Pc4 PULSATIONS AT A NETWORK OF STATIONS. Kopytenko, Yu. A.; Raspopov, O. M.; Troitskaya, V. A.; Shlich, R. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 627-631(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 720-726(1972).

The behavior of Pc4 pulsations at the magnetically conjugate points Sogra and Kerguelen ($\Phi_m \sim 58°$) and at a network of stations in the northern hemisphere is analyzed from the results of synchronous observations of short-period pulsations in the autumn of 1964 and the spring of 1966. Individual segments of the pulsation record are subjected to spectral analysis. On the basis of the behavior of the amplitudes of pulsations at the network of stations it is assumed that Pc4 are generated in magnetospheric resonators. The quality of these resonators does not usually exceed 10. The rate of energy dissipation by a resonator of this kind averages 5×10^{16} erg/sec and may amount to 10% or more of the total rate of dissipation of the energy of the belt of trapped radiation responsible for the DR current during the recovery phase of a geomagnetic storm. (auth)

28525 NORMAL FIELD OF SQ VARIATIONS. Berdichevskii, M. N.; Borisova, V. P.; Rotanova, N. M.; Fainberg, E. B. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 635-637(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 731-733(1972).

The field of quiet-day solar daily variations, averaged over 1958, is analyzed and a network of stations is singled out where the field is not complicated by high space frequencies. (auth)

28526 AVERAGE DIURNAL VARIATION OF THE ENERGY RELEASE BY AURORAS IN THE TIXIE BAY AREA. Dzyubenko, N. I. (Kiev State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 649-650(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 746-747(1972).

Formulae are given for determination of the average diurnal variation of the energy flux density of auroral electrons. The determination of the average diurnal variation in the Tixie area, located somewhat to the south of the maximum auroral isochasm, was made using visual observations at this station over eight winter months (December–March) from 1957 to 1968. The area of the sky was divided into three zones, zenith with $z < 30°$, northern (Nl, $z = 30$ to 60°), and southern (Sl, $z = 30$ to 60°). The latitudinal extent of these three zones is approximately the same. The average auroral brightness distribution over the entire region observed during the observation period reaches ≈0.5 kilo-Rayleighs around midnight at Tixie. (JCW)

28527 STATIONARY DIFFUSION OF A MINOR ATMOSPHERIC COMPONENT AT NIGHT FOR A NONLINEAR RECOMBINATION LAW. Mikhailov, A. V. (Inst. of Applied Geophysics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 651-653(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 748-750(1972).

The vertical distribution of particle density in the case of nonlinear recombination is investigated and compared to linear recombination. Binary reaction and triple collisions are recombination types considered. Results can be applied to a study of atomic oxygen in the height interval where it is a minor atmospheric component. (JCW)

28528 POSSIBLE EXPLANATION FOR THE NIGHTTIME h_{max} AND n_e ENHANCEMENT IN THE IONOSPHERIC F2 LAYER. Mikhailov, A. V. (Inst. of Applied Geophysics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 653-655(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 751-752(1972).

A model is constructed of nighttime h_{max} and n_e enhancements on the assumption that a time-variable diffusion flux of charged particles exists at the upper boundary of the F region. Experimental data on incoherent backscatter of radio waves shows enhancements of electron density and of the height of the F2 layer at night in winter. The effect occurs between 22 h and 4 h LT and lasts several hours. In this case, h_{max} increases by ≈10 km and n_e by a factor of ≈1.5. Electron density reaches its maximum first at greater heights and then with some delay at lower heights. The height of h_{max} reaches its maximum somewhat earlier than does electron density. Allowance for the time variable charged-particle flux from the exosphere into the F region makes it possible, in principle, to explain the h_{max} and the n_e enhancement at night. (JCW)

28529 VARIATIONS OF THE GLOBAL VALUES OF F2-LAYER THICKNESS AND PARAMETERS OF THE NEUTRAL ATMOSPHERE. Shapiro, V. S.; Anufri'eva, T. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 655-657(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 752-754(1972).

The half-thickness y_m of the ionospheric F2 layer must be a measure of the scale height H_n and temperature T_n of the neutral atmosphere at the level of the h_{max} F2 maximum ($y_m \approx 2\ H_n$) as revealed from previous data. An investigation was made of maps of the global distribution of h_{max} and y_m for periods of low, high, and very high solar activity. Models 1, 5, and 9 of the standard CIRA-65 atmosphere are based on average global scale data and were used in the investigation. Global h_{max} and y_m values were analyzed in two variants: the average values over all latitudes of the northern and southern hemispheres and over all latitudes, except the equator. In the second analysis, it is assumed that h_{max} and y_m refer to middle latitudes since the maps do not take into account data for high latitudes. Results show the global $y_m F2$ values to have diurnal and cyclic variations of the scale height and temperature of the neutral atmosphere. (JCW)

28530 EFFECT OF MAGNETIC DISTURBANCES ON THE F2 LAYER. Artem'eva, G. M.; Pisareva, V. V. (Gorky Radio Physics Inst., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 657-659(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 755-756(1972).

The slow variations of average f_0F2 values and diurnal (in LT) sums of the K_p index were investigated. Curves of day-to-day variations were constructed for 1957, 1958, 1960, and 1964 and the cross-correlation functions of ΣK_p and average 4-hour f_0F2 values (Moscow) were computed for various seasons. The computed coefficients of correlation between ΣK_p and f_0F2 are given for 1957. Other correlations cited from experiments include data on time of day, hemispheric locations, solar activity, conjugate regions, latitudinal and longitudinal dependencies. (JCW)

28531 ROLE OF METAL IONS IN E_s-LAYER FORMATION. Ignat'ev, Yu. A.; Lisina, N. I. (Gorky Radio Physics Inst., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 659-661(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 756-757(1972).

Data on the possibility of formation of thin sporadic-E layers through redistribution of the metal ion profile known from experiments were investigated. Expressions for the vertical distribution of electrons and ions are obtained from the equations of motion and continuity for charged plasma components. The reason for the important role of metal ions in the formation of the middle-latitude sporadic-E layer is that the formation time of the sporadic-E layer, through wind shears, from the NO^+ and O_2^+ ions predominating in the E region is greater than the lifetime of these ions, which is limited by the recombination process. Mass spectrometer measurements of the ion composition of the lower ionosphere showed the presence in the E region of layers of metal ions with a density to 10^4 cm^{-3} and a half-width of 5 to 10 km. (JCW)

28532 E_s IN THE EQUATORIAL REGION ACCORDING TO OBSERVATIONS ON THE R/V AKADEMIK KURCHATOV. Chernysheva, S. P.; Vasil'ev, K. N.; Sheftel, V. M. (Rostov State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 661-662(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 758-759(1972).

The variations of some of the E_s-layer characteristics in the Gulf of Guinea region (3 to 23°S, 10°W to 10°E) were investigated from the data of the expedition on the R/V Akademik Kurchatov in April–June 1968. At that time there were no significant variations in the values of the parameters studied. The following E_s characteristics were investigated: the probability of E_s reflections of a duration τ exceeding the given value $(pE_s)\tau \geq \tau_0$; the duration of continuous reflections from the $E_s - \tau$ E_s; the distribution curves of f_0E_s and f_bE_s; and the frequency of appearance of several layers one above the other. The investigations were made with and without E_s separation into types. Analysis showed that the position of the observation point determines the variation of the E_s parameters. The time interval during which an E_s layer with $\tau > 4$ hours was observed decreased substantially with increasing geographic latitude φ. The probability of E_s reflections decreased from the equator southward within the region studied. (JCW)

28533 CHARACTERISTICS OF SUNRISE PHENOMENA DURING PCA EVENTS. Beloborodova, A. A.; Belikovich, V. V.; Benediktov, E. A.; Gusev, A. I.; Los, B. P.; Shabanov, Ya. A. (Inst. of Cosmophysical Investigations and Aeronomy, Yakutsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 662-664(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 760-761(1972).

Characteristics of PCA-related sunrise observations at Loparskaya on Sept. 3, 1966 at a frequency of 13 MHz and at Vostok Station in Antarctica on Sept. 2, 1966 at a frequency of 20 MHz were studied. The sunrise functions have qualitatively the same form at sunrise at middle latitudes on medium waves according to the A3 method. Other observations are cited and it is observed that the steplike variation of absorption at sunrise reflects patterns of microprocesses in the lower part of the D region that are common to polar and temperate latitudes. The main ionization source at temperate latitudes are galactic cosmic rays and, at polar latitudes during PCA, solar cosmic rays. Characteristics of sunset phenomena during PCA events are also presented. (JCW)

28534 EQUATORIAL ELECTROJET ACCORDING TO KOSMOS-321 MEASUREMENTS. Dolginov, Sh. Sh. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 611-617(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 699-707(1972).

The magnetic effects of the equatorial electrojet measured by Kosmos 321 are compared with those measured at magnetic observatories. These data are used to determine the depth of the nonconducting layer of the earth in the framework of the McNish-Chapman induction model. (26 references) (auth)

28535 VERTICAL CURRENTS AT CONJUGATE POINTS. Magnitskii, B. V.; Tverskoi, B. A. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 618-620(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 708-711(1972).

The effect of different conductivities in the ionospheric E layer in the northern and southern polar caps on the asymmetric ring current is analyzed. It is demonstrated that the existence in ionospheric polar caps of conductivities of different magnitude produces a current that flows along high-latitude magnetic lines of force from one hemisphere to another during the development of a substorm. The density of this current is estimated. (auth)

28536 DIFFUSION SPREADING OF WEAK PLASMA INHOMOGENEITIES IN THE PRESENCE OF TWO KINDS OF POSITIVE IONS. Zhmur, L. E. (Gorky State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 565-567(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 641-644(1972).

Problems concerning the diffusion theory of weak inhomogeneities in a weakly ionized plasma in the presence of two kinds of positive ions are investigated. The spreading of inhomogeneities is characterized by two relaxation times. The values of these times and the amplitudes of the Fourier components are found for a disturbance. (auth)

28537 FREQUENCY DEPENDENCE OF ABSORPTION. II. NUMERICAL EXPERIMENT. Kalinovskaya, G. P. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Novosibirsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 568-572(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 645-650(1972).

The frequency variation of absorption is investigated by the method of expansion of the fields into natural orthogonal components with subsequent application of the method of least squares to determine the exponent n in the expression for the index of nondeviative absorption. The changes in the frequency variation of absorption are examined as a function of time of the day, season, and solar activity. (auth)

28538 EFFECTIVE RECOMBINATION COEFFICIENT IN THE IONOSPHERIC D REGION. Belikovich, V. V.; Itkina, M. A. (Gorky Radio Physics Inst., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 573-577(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 651-656(1972).

The vertical profile of the effective loss coefficient $\alpha(h)$ in the ionospheric D region during sudden ionospheric disturbances is found. The computations are performed on the assumption that quasi-equilibrium conditions are satisfied, using data on solar x-ray fluxes in the ranges 0.5 to 3, 1 to 8, and 8 to 16 Å and the results of riometer measurements of anomalous absorption at frequencies of 13 and 25 MHz. The function $\alpha(h)$ was assumed to be smooth and monotonic. When computing $\alpha(h)$ during a disturbance, allowance was also made for ionization under quiet conditions. The results obtained are not at variance with the data of other researchers. (auth)

28539 ISOTHERMAL IONIZATION OF THE LOWER IONOSPHERE UNDER THE EFFECT OF RADIO WAVES. Gurevich, A. V. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 556-564(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 631-640(1972).

The isothermal ionization of the lower ionosphere at heights $z \sim 60$ to 30 km as a result of the heating of the air in the field of strong radio waves is investigated. It is demonstrated that a radio wave of power $W \sim 10$ to 100 kW at frequencies $\omega \sim 10^8$ to 10^{10} can sustain isothermal ionization $N \sim 10^8$ to 10^{10} cm^{-3} in a region measuring $R_0 \sim 1$ to 10 m. A theory of a high-frequency isothermal discharge is presented in the approximation of geometrical optics. It is shown that for large values of W the ionization distribution in the discharge acquires an oscillatory structure. (auth)

28540 N(h) PROFILE AND ALLOWANCE FOR HORIZONTAL IONOSPHERIC INHOMOGENEITY. Danilkin, N. P.; Mal'tseva, O. A. (Rostov State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 551-555(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 625-630(1972).

The possibility of obtaining information on horizontal electron-density gradients in the plane of the magnetic meridian from a combined analysis of the group delays of both magnetoionic components is investigated. Data on lateral deflections for the N(h) profiles of the upper and lower ionosphere are analyzed. Relations that associate the magnitude of a horizontal inhomogeneity with vertical ionospheric sounding data are presented. (auth)

28541 GLOBAL IONOSPHERIC INHOMOGENEITIES. Vsekhsvyatskaya, I. S.; Kalinin, Yu. K.; Serge'enko, N. P.; Yudovich, L. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 548-550(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 622-624(1972).

Data on the statistical variability of F2-layer critical frequency (δf_0F2), analyzed using an excessively asymmetric model, give an idea of global ionospheric inhomogeneities (measuring more than 1000 km) and permit determining the effective number of inhomogeneities affecting δf_0F2. Use of data on the radius of coverage of an ionospheric station makes it possible to determine the characteristic dimension of inhomogeneities of this kind, which is found to depend little on latitude. (auth)

28542 NATURE OF AURORAL EMISSION INTENSITY PULSATIONS ASSOCIATED WITH GEOMAGNETIC PULSATIONS OF THE Pi2 TYPE. Koshelevskii, V. K.; Raspopov, O. M.; Roldugin, V. K. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 545-547(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 618-621(1972).

Synchronous records of geomagnetic Pi2 pulsations and auroral emission intensity pulsations PI are compared and a close correlation between the two phenomena is found. There is good agreement between the spectral composition of both types of pulsations. The PI can be divided into two classes, depending on the nature of the development of auroral phenomena: burstlike PI_a and smooth PI_b, which differ in their morphological properties. The PI can be interpreted on the basis of an analysis of the modulation of the development of plasma instabilities by an MHD wave. (auth)

28543 SECOND POSITIVE SYSTEM OF NITROGEN BANDS IN DAYGLOW ACCORDING TO KOSMOS-224 DATA. Krasnopol'skii, V. A. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 533-536(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 603-607(1972).

Profiles of the emission of $N_2(C^3\pi_u - B^3\pi_g)$ bands are obtained. The excitation of these bands under the effect of photoelectrons and electrons precipitating from radiation belts is computed for various solar zenith angles at moderate solar activity. The contribution of the latter particles does not exceed 10% of the total emission. There is good agreement between experiment and computations. The effect of solar activity on emission intensity is estimated. (auth)

28544 DAYTIME 3914-A N_2^+ EMISSION ACCORDING TO KOSMOS-224 DATA. Krasnopol'skii, V. A. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 537-540(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 608-612(1972).

Profiles of 3914-Å N_2^+ emission at heights 110 to 240 km are obtained for $z_\odot = 40°$, 57°, and 67.5° at moderate solar activity. They differ markedly from analogous data for low solar activity. The results of computations of emission excitation by photoelectrons, precipitating electrons, and solar radiation at $\lambda < 660$ Å agree with experimental data. The remaining part of emission is produced by the resonance scattering of solar radiation on N_2^+ ions. The density of these ions agrees well with mass-spectrometer measurements. (21 references) (auth)

28545 VISIBLE-AIRGLOW EXPERIMENT ON ATMOSPHERE EXPLORER. Hays, P. B. (Univ. of Michigan, Ann Arbor); Carignan, G.; Kennedy, B. C.; Shepherd, G. G.; Walker, J. C. G. Radio Sci.; 8: No. 4, 369-377(Apr 1973).

The visible-airglow experiment is an airglow photometer designed to measure various thermospheric emission features during the day and night both at low latitudes and in auroras. The photometer has two distinct optical channels, a high-sensitivity channel with a large field of view and a low-sensitivity channel with a narrow field of view to resolve small features. The system is protected by a combination attenuator and cathode back-biasing scheme that allows measurements of maximum sensitivity within a fraction of a second of viewing the Sun. This experiment will be a part of the scientific payload on all three Atmosphere Explorer missions. (auth)

28546 LOW-ENERGY ELECTRON EXPERIMENT FOR ATMOSPHERE EXPLORER-C AND -D. Hoffman, R. A. (Goddard Space Flight Center, Greenbelt, MD); Burch, J. L.; Janetzke, R. W.; McChesney, J. F.; Way, S. H.; Evans, D. S. Radio Sci.; 8: No. 4, 393-400(Apr 1973).

The low-energy electron experiment will provide differential measurements of the energy influx and angular distributions of electrons and protons on the Atmosphere Explorer-C and -D missions. The detectors consist of cylindrical electrostatic analyzers for species and energy selection and Spiraltron electron multipliers as particle sensors. The C version will contain three detectors, two measuring electrons and protons from 0.2 to 25 keV in 16 logarithmically-spaced steps and one measuring 5-keV electrons continuously. Angular distributions will be acquired utilizing the spin of the spacecraft. The D version will contain 19 detectors, one proton-stepped energy analyzer, and two electron-stepped energy analyzers at two different angles, again over the energy range 0.2 to 25 keV. In addition it will contain 16 fixed-energy detectors that will obtain high time-resolution angular distributions in the spacecraft one-revolution-per-orbit mode at five energies between 0.2 and 5 keV. Increase of these energies by a factor of 3.5 will be possible by ground command. (auth)

28547 AURORAL OVAL: A REEVALUATION. Eather, R. H. (Boston Coll., Chestnut Hill, MA). Rev. Geophys. Space Phys.; 11: No. 1, 155-167(Feb 1973).

The auroral oval represents a region of auroral occurrence where particular spectral features have sufficient integrated intensity to exceed all-sky camera thresholds. It has been argued that this is not a good representation of the characteristics of particle precipitation or of energy deposition. Consequently, the auroral oval concept may not be a good one to use to order diverse auroral data on a 24-hour basis. Rather, the precipitation patterns for specific energy classes of protons and electrons should form the basis for the interpretation of high-latitude geophysical measurements. (22 references) (auth)

28548 AURORAL HELIUM PRECIPITATION. Reasoner, D. L. (Rice Univ., Houston, TX). Rev. Geophys. Space Phys.; 11: No. 1, 169-180(Feb 1973).

Several measurements of the flux and charge state of auroral helium precipitation have been made and reported between 1967 and 1972. The primary purpose of these experiments has been to deduce the source location of auroral ions by comparison of auroral helium populations with those measured in the ionosphere and the solar wind. Accordingly, results of these experiments are reviewed and summarized, along with measurements of solar wind and ionospheric helium abundances. It is concluded that the available data suggest a solar wind origin of auroral ions and, in addition, place certain constraints on the acceleration mechanism. The problem of modification of the incident charge state of a helium beam by atmospheric charge exchange is discussed, and it is shown that auroral helium measurements should be made at altitudes above 400 km to insure that the measurements are a true indication of the original beam charge-state composition. Attempts to measure optical emissions of auroral helium are also reviewed, with the conclusion that definitive reproducible detection of such emissions has not been accomplished to date. (47 references) (auth)

28549 RECENT PROGRESS IN THE STUDY OF IONOSPHERIC STORMS. Somayajulu, Y. V. (National Physical Lab., New Delhi). J. Sci. Ind. Res.; 30: No. 8, 394-407(Aug 1971).

The results of up-to-date studies on ionospheric storms by various ground-based and satellite-borne techniques are reviewed. Studies on geomagnetic storms are also summarized. In Part I, the ionospheric parameters available for study and the observational techniques employed to measure them are described. Part II describes the average features and development of the ionospheric storms based on f_0F2 data. In Part III, a review of the significant results obtained mainly on the topside ionosphere and the outer ionosphere using space techniques and ground-based incoherent scatter radar and whistler techniques is presented. A description of the relevant recent results on the magnetosphere during storms follows. Lastly, the physical mechanisms and processes are discussed in relation to the relevance of various theories in the understanding of the dynamics of ionospheric storms. (129 references) (JCW)

28550 SOME ASPECTS OF THE ELECTRODYNAMICS OF THE IONOSPHERE AND THE MAGNETOSPHERE. Cole, K. D. (La Trobe Univ., Bundoora, Australia). J. Sci. Ind. Res.; 30: No. 8, 388-393(Aug 1971).

The basic theory of the electrodynamics of the ionosphere and magnetosphere is reviewed. In view of the ionospheric dynamo and magnetospheric motor, topics discussed include hemispheres decoupled, constant conditions; large-scale deformation of the ionosphere; small-scale irregularities in the ionosphere; microscale irregularities in the ionosphere; magnetospheric effects; thermospheric effects; and effects of coupling between unsymmetrical hemispheres. Topics discussed under the magnetospheric dynamo–ionospheric motor point of view are magnetospheric effects, ring current, plasmapause; stable auroral red arc; Joule heating: winds in the lower E region; winds in the upper thermosphere; and density and temperature changes in the auroral thermosphere. (58 references) (JCW)

28551 RESULTS OF RESEARCHES ON THE INTERNATIONAL GEOPHYSICAL PROJECTS. Ionos. Issled.; No. 21, 1-212(1972). (In Russian).

Data of experimental and satellite research performed in the ionosphere are presented in thirty-nine papers. Dependences of ionization, gravitational- and radio-wave propagation, and electron concentration on solar activity, solar energy, magnetic-field

activity, solar zenith angles, seasons, diurnal variations, disturbances, time, position, and all other parameters that affect the ionospheric properties are discussed. Methods used for the studies are described. (JCW)

Magnetospheric Phenomena

Refer also to abstracts 28511 and 28550.

28552 PROPAGATION OF WHISTLERS AND GYROELECTRIC ECHOS AT MIDDLE LATITUDES. Garnier, M.; Nakache, J. (Univ., Paris). Ann. Geophys.; 28: No. 3, 509-517(Jul 1972).

The magnetospheric paths of middle-latitude whistlers are compared to those of artificial signals generated by vlf transmitters and received at the same location. It is concluded that, in most cases, nonguided propagation through the magnetosphere takes place, but only signals coming along paths whose feet are located above the receiving station are detected. (FR)

28553 CORRELATION OF GROUND-BASED MEASUREMENTS OF STRUCTURED Pc1 MICROPULSATIONS WITH OGO-V PLASMAPAUSE OBSERVATIONS. Mullen, A. J.; Heacock, R. R. (Univ. of Alaska, College). Ann. Geophys.; 28: No. 3, 519-525(Jul 1972).

The times and L values for 200 OGO-V satellite crossings of plasmapause in 1968 were compared to occurrences of structured Pc1 micropulsation events. Micropulsation records from College and Kotzebue in Alaska and from Sodankyla and Nurmijarvi in Finland were examined. There were 24 intervals of Pc1 activity occurring within several hours, in both local and universal time, of an OGO-V crossing, and there was a total of 34 separate events in the 24 intervals. For 31 of the 34 events, the plasmapause was outside the L shell of the site recording the largest Pc1 amplitude. The other three cases were very weak in intensity and may have represented horizontal propagation from a more distant L shell. The comparisons clearly imply that the Pc1 source lines were in the plasmasphere. Separate calculations based on the scaled bounce periods of the Pc1 wave packets also found the source lines to be within the plasmasphere. The results are consistent with a requirement that the equatorial plane cold plasma density must exceed a certain value in order that the proton cyclotron instability shall occur. (FR)

28554 RAYED AURORAL STRUCTURES AND THEIR RELATION TO THE DRIFT CURRENT INSTABILITY IN A PLASMA BLOB. Men'shutina, I. N. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 541-544(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 613-617(1972).

The possible development of the pinch effect in the Earth's magnetosphere is examined. The rate of growth and particle density necessary for the development of "constrictions" with a given wavelength are estimated. It is demonstrated that particle density in a plasma blob is sufficient for the development of disturbances with a wavelength of 10 to 10^2 km in the equatorial plane. Such wavelengths can be associated with periodic structures observed during a "breakup." (auth)

28555 VARIATIONS OF SOLAR-WIND PARAMETERS, MAGNETIC ACTIVITY, AND THE ELECTRON TAIL OF THE MAGNETOSPHERE AND OF THE OUTER RADIATION ZONE. Ivanov, K. G.; Mikerina, N. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 602-605(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 688-692(1972).

The relation of variations in solar-wind parameters with magnetic activity and the electrons of the magnetosphere is investigated for magnetospheric storms of the periods July 5 to July 12 and September 26, 1966. It is confirmed that variations of the southern component of the interplanetary magnetic F_S and of the eastern component of the electric E_F fields have the closest relationship with variations of the K_p index. These results agree quantitatively with the corollaries of the hypothesis of the reconnection of the interplanetary and geomagnetic fields. (34 references) (auth)

28556 INSTABILITY OF THE CURRENT IN THE NEUTRAL SHEET OF THE TAIL OF THE EARTH'S MAGNETOSPHERE. Pokhotelov, O. A. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 606-610 (1972).

Translated from Geomagn. Aeron.; 12: No. 4, 693-698(1972).

Anisotropic plasma instability in the absence of a constant magnetic field is analyzed. It is demonstrated that a "plateau" forms in the low-velocity region as a result of quasi-linear plasma relaxation on the electron distribution function. The results of the theory are applied to an analysis of the stability of the current in the neutral sheet of the tail of the magnetosphere. It is shown that in this case the current plays the role of anisotropy. (auth)

28557 GEOMAGNETIC STORM FAMILIES, DIRECTION OF THE INTERPLANETARY MAGNETIC FIELD, AND SOLAR ACTIVITY. Afanas'eva, V. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 621-626(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 712-719(1972).

Information on geomagnetic storm families in 1962–1967 is compared with data on the sector structure of the interplanetary magnetic field. It is demonstrated that the number of families within an individual sector is independent of the direction of the interplanetary magnetic field; the boundaries between sectors coincide in 40% of the cases with the principal days of storm families; the distribution of geomagnetic activity within a sector is supported by the relative intensity of families within the sector; an individual sector is produced by solar activity in a definite region of solar longitudes within which active formations change significantly from one solar rotation to another. (auth)

28558 THRESHOLD OF APPEARANCE OF ANOMALOUS RESISTANCE FOR FIELD-ALIGNED CURRENTS IN THE MAGNETOSPHERE. Volosevich, A. V.; Liperovskii, V. A. (Polar Geophysical Inst., Kola, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 670-672(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 767-769(1972).

It is shown that currents flowing along geomagnetic lines of force must be accompanied by ion-acoustic turbulence that produces anomalous resistance. Models are shown for the appearance of turbulence and of anomalous resistance in a nonisothermal infinite plasma, namely, in turbulent magnetospheric currents. Magnetospheric turbulence is shown to be manifested in a decrement of short-period geomagnetic pulsation attenuation, the character of auroras, and in radio reflections from the auroral ionosphere. (JCW)

28559 EFFECT OF THE INTERPLANETARY MAGNETIC FIELD ON GEOMAGNETIC ACTIVITY. Kuli'eva, R. N. (Inst. of Physics, Novosibirsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 673-674(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 770-771(1972).

Investigations have shown the interplanetary magnetic field to have a sector structure consisting of positive (lines of force directed away from the Sun) and negative (lines of force directed toward the Sun) sectors. The number of sectors around the Sun differs at different times and depends on the distribution of solar activity. An investigation was made of the dependence of geomagnetic activity on the sector (positive and negative) in which the Earth is located on the basis of data on the sector structure of the interplanetary magnetic field and on the C9 activity index. Two samples are shown of positive and negative sectors for the period from Dec. 12, 1964 to Dec. 31, 1968. Except for the frequency of category 6 in the positive sector, C9 frequencies have the same distribution in both sectors. (JCW)

28560 EFFECT OF THE INTERPLANETARY MAGNETIC FIELD ON CHARACTERISTICS OF Pc2–4 PULSATIONS. Plyasova-Bakunina, T. A. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 675-677(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 772-773(1972).

There are two possibilities of the localization of sources of Pc2–4 pulsations: wave generation in the magnetosphere or at its boundary and wave generation in the interplanetary medium. Theories have dealt primarily with the pulsation sources being in the magnetosphere or at its boundary. An experimental investigation is proposed to verify the hypothesis of an extramagnetospheric origin of Pc2–4. Corollaries analyzed here include: the dependence of the probability of Pc2–4 occurrence on the orientation of the interplanetary magnetic field; and the relationship between the periods of pulsations observed simultaneously at the surface of the Earth and ahead of a shock-wave front. It is concluded that hydromagnetic waves excited in the interplanetary medium in the vicinity of a shock wave front contribute to the spectrum of Pc2–4 pulsations observed on Earth. (JCW)

28561 SYNCHRONOUS DEVELOPMENT OF PDP MICROPULSATIONS AND ASYMMETRY OF THE RING CURRENT DURING THE MAGNETIC STORM OF MARCH 13–15, 1966. Mal'tseva, N. F. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 12: No. 4, 677-679(1972).

Translated from Geomagn. Aeron.; 12: No. 4, 774-776(1972).

PDP micropulsations are hydromagnetic emissions generated by an instability developing during proton injection into the outer radiation belt. The longitudinal asymmetry of PDP frequency spectra is probably produced by the azimuthal drift of proton formations that generate the PDP to the west of the injection re-

gion and the same process produces the simultaneous asymmetric development of the outer ring current and the appearance of negative low-latitude bays. The space–time relationship of PDP and DS during the magnetic storm of March 13–15, 1966 was traced to investigate the relationship between PDP generation and the formation of the asymmetry. Highlights of the storm hour by hour are enumerated. The development of the storm was analyzed from magnetic-field observations on the OGO-2 satellite and PDP micropulsation data were obtained from Borok, Irkutsk, and College. (JCW)

28562 TWO-DIMENSIONAL MODEL OF THE MAGNETOSPHERE WITH A CURRENT SHEATH. Krylov, A. L. (Inst. of Physics of the Earth, Moscow). Dokl. Akad. Nauk SSSR; 207: No. 1, 90-93(1 Nov 1972). (In Russian).

A two-dimensional model of the Earth's magnetosphere and the solar wind flowing around it, previously proposed by other workers (1959–61), is reconsidered here in connection with various patterns of the topology of the lines of force. This led to a problem in the theory of functions and assumed a solution in quadratures. (KSW)

28563 SOME EFFECTS OF MAGNETOSPHERIC ACCELERATION MECHANISMS ON VARIATIONS IN ULTRAVIOLET INTENSITY HEIGHT PROFILES, AND ON CONSEQUENT ROCKET SPECTROGRAPH SENSITIVITIES. Catchpoole, J. R. (York Univ., Toronto). J. Atmos. Terrest. Phys.; 35: No. 5, 861-870 (May 1973).

An estimate is made of typical height profiles of auroral ultraviolet radiation; and such distributions for the emission of radiation of wavelength 1304 Å are presented. These are based on a model primary beam incident on the atmosphere at particular colatitudes. Also considered are the variations of these profiles due to two magnetospheric acceleration mechanisms—one the field line convergence, an inherent function of the colatitude of precipitation, and the other a longitudinal electric field. These affect pitch distributions; and so, in turn, atmospheric penetration, the height distribution of secondary production and the resulting emission profiles. These profiles are compared with a previously used model based on visible measurements, in order to produce factors that can be used to modify earlier estimates of the response of a spectrograph used in rocket experiments. (auth)

28564 NEW NOSE EXTENSION METHOD FOR WHISTLERS. Bernard, L. C. (Stanford Univ., CA). J. Atmos. Terrest. Phys.; 35: No. 5, 871-880(May 1973).

The dispersion $D = tf^{\frac{1}{2}}$ of ducted whistlers is approximated by $D = D_0(f_{HE} - Af)/(f_{HE} - f)$, where f is the whistler frequency, t the travel time and f_{HE} the minimum electron gyrofrequency along the propagation path. D_0 is the zero-frequency or Eckersley dispersion, and the parameter A depends on detailed distribution of electron gyrofrequency and plasma frequency along the path. Based on this approximate dispersion function, methods are developed by which the nose frequency f_n and the travel time at the nose t_n can be calculated from measurements of travel time at any two frequencies. The formulas for f_n and t_n involve only simple algebraic functions and therefore permit speedy data processing with high precision. When applied to nose whistlers, this method often allows better estimates of f_n than are possible by direct measurements. This is particularly important in measurements of magnetospheric east–west convection electric fields using cross-L drifts of whistler ducts. (auth)

28565 MAGNETOSPHERIC SUBSTORMS: SOME PROBLEMS AND CONTROVERSIES. Vasyliunas, V. M.; Wolf, R. A. (Rice Univ., Houston, TX). Rev. Geophys. Space Phys.; 11: No. 1, 181-189(Feb 1973).

This description of work on magnetospheric substorms is summarized from discussions at the Rice University–AGU Conference on Magnetospheric Substorms. Various types of new data were presented, including Isis-2 scanning photometer observations of the aurora from above and lunar shadowing observations made from the Apollo-15 subsatellite. The subject of greatest controversy was the substorm growth phase: gaps in the network of ground magnetometer stations can result in the expansion phase of one substorm being mistaken for the growth phase of another, and there was considerable debate over whether this observational ambiguity could invalidate popular ideas about the growth phase and its signatures, Correlations between magnetospheric phenomena and the direction of the interplanetary magnetic field constituted another area of considerable discussion: the picture appears complicated, with different magnetospheric phenomena correlating with different components of the interplanetary magnetic field. Controversies arose anew of whether the magnetosphere is open or closed and the general pattern of the average magnetospheric electric field: it now seems generally agreed that there is direct connection between interplanetary and magnetospheric magnetic-field lines, although the details of the connection process remain uncertain, and electric-field measurements from balloons and satellites have convincingly verified the existence of systematic magnetospheric convection, with dawn-to-dusk electric fields over the polar caps. A variety of theoretical approaches to the substorm problem are being pursued, (auth)

28566 WHAT IONOSPHERIC WORKERS SHOULD KNOW ABOUT THE PLASMAPAUSE–PLASMASPHERE. Carpenter, D. L.; Park, C. G. (Stanford Univ., CA). Rev. Geophys. Space Phys.; 11: No. 1, 133-154(Feb 1973).

Recent research on the structure and dynamics of the magnetospheric thermal plasma indicates that the vast region above an altitude of ~1000 km rivals the underlying ionosphere in complexity and that it is coupled to the lower region in complicated, physically important ways. An example involves the relation of the electron content of magnetospheric tubes of ionization to the electron content of the regular ionosphere. Tube volume between ~1000 km and the magnetic equator varies rapidly over a relatively small range of tube end point latitudes, which gives rise to correspondingly rapid variations with latitude in coupled effects that involve interchange of ionization between the upper and lower regions. In the past, some correlative studies involving the plasmapause have been hindered by lack of information concerning (1) the unsteady nature of the process by which the disturbed-time plasmapause profile is established and (2) the fact that at most times and at most locations the plasmasphere–plasmapause system is in a state of recovery. A series of equatorial density profiles is shown to illustrate the reduction of plasmapause radius during brief periods of increased disturbance and the recovery of the plasmasphere by various processes, particularly by filling from the underlying ionosphere. Research results are presented of a "quick-reference guide" to the plasmasphere. To the ionospheric observer, the plasmapause should appear to have a complex but generally predictable geometry as well as characteristic motions. A crude predictor of plasmapause L value (L_{pp}) in the post-midnight period as a function of magnetic disturbance is the formula $L_{pp} = 5.7$ to 0.47 Kp, where Kp is the maximum 3-h Kp value in the preceding 12 hours. A ground station at $L \sim 3.7$ is recommended as optimum for observation of plasmapause-associated effects directly overhead. The plasmasphere is regularly perturbed by substorm-associated convection electric fields, and these apparently have important effects on the nightside ionosphere at middle latitudes. Other known departures of the plasmasphere from corotation are expected to have their counterparts in the ionosphere. (54 references) (auth)

28567 STORMS IN THE MAGNETOSPHERE. Kremser, G.; Muench, J. W. (Max-Planck-Institut fuer Aeronomie, Lindau, Ger.). Weltraumfahrt Raketentech.; 22: 154-157(1971). (In German).

The structure of the magnetosphere is examined, giving attention also to questions regarding the processes that maintain the radiation belt. Disturbances in the magnetosphere are connected with the solar wind. Storms occur at times when solar wind with changed characteristics reaches the Earth. The change in solar-wind characteristics involves a pronounced increase in flux density and energy of protons and electrons. The storms can last several days. Magnetospheric substorms occur much more often than these storms. (IAA)

28568 ANALYSES OF TECHNIQUES FOR MEASURING DC AND AC ELECTRIC FIELD IN THE MAGNETOSPHERE. Mozer, F. S. (Univ. of California, Berkeley). Space Sci. Rev.; 14: No. 2, 272-313(Feb 1973).

Methods for measuring the amplitudes and directions of dc electric fields and the directions, power spectra, and dispersion relations of ac electric fields in the magnetosphere are discussed with emphasis on their applicability in various regimes of the magnetospheric plasma. The two classes of techniques that are discussed are measurement of the bulk flow of the plasma and the potential difference between pairs of separated conductors. The plasma bulk flow discussion includes measurements by ionospheric radar backscatter, whistler mode wave propagation, energetic or thermal particle trajectories, artificial ion cloud motion, probe measurements of bulk flow, vehicle wake analyses, effects of bulk flow on the coupling of antennas, and the bulk flow of an artificial electron beam. (153 references) (auth)

28569 STRUCTURE OF THE MAGNETOSPHERE. Tandon, J. N. (Univ. of Delhi). J. Sci. Ind. Res.; 30: No. 8, 371-378 (Aug 1971).

The physical regimes at different levels in the Earth atmosphere are discussed regarding nomenclature and characteristic constituents. The magnetosphere, the region in which the Earth's

magnetic field controls the dynamics of the atmosphere, is discussed in detail. Many proposed models of the magnetosphere are presented and compared with results obtained from satellite data. The two competitive models that are in conformity with observations are those of J. W. Dungey and A. J. Dessler. (21 references) (JCW)

28570 MAGNETOSPHERIC PLASMA: SOURCES, WAVE–PARTICLE INTERACTIONS, AND ACCELERATION MECHANISMS. Speiser, T. W. (Univ. of Colorado, Boulder). J. Sci. Ind. Res.; 30: No. 8, 408-413(Aug 1971).

Problems basic to magnetospheric physics are reviewed. The sources of magnetospheric plasma, with auroral particles included as a subset, are discussed. The ultimate source of the plasma is considered to be the solar wind and the possible ways the solar-wind plasma can gain access to the magnetosphere are presented. Other possible sources of magnetospheric plasma include cosmic-ray albedo neutron decay, neutral hydrogen in the solar wind, and ionospheric plasma. The consequences of wave-particle interactions and the energization or acceleration mechanisms are discussed. (21 references) (JCW)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstract 28357.

28571 (CEA-N-1558) ION TRAJECTORIES IN AXIALLY SYMMETRIC FIELDS WITH SPACE CHARGE. TRAJIN Program. Dudon, F. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Dec 1972. 26p. (In French). Dep. NTIS (U. S. Sales Only) $3.50.

The TRAJIN subroutine calculates the trajectories of an ion beam in time independent electric and magnetic fields, space charge effects being taken into account. The initial distribution of the ion beam and the fields is symmetrical with respect to axis along which the beam is propagated. Analytical formulas are used to calculate the fields. The TRAJIN subroutine is used to calculate the trajectories of certain ions, the beam envelope, and the focusing diagrams for the beam. TRAJIN is a FORTRAN subroutine whose memories are provided with arguments from the caller. Calculations made with TRAJIN are justified, and details of its use are given. (France)

28572 SOURCE OF POLARISED ELECTRONS. Campbell, D. M.; Brash, H. M.; Farago, P. S. (Univ. of Edinburgh). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 165-180(1972).

A prototype source of polarized electrons is described, in which electrons trapped by a combination of electric and magnetic fields are polarized through spin exchange interaction with a polarized beam of potassium atoms. Under typical operating conditions, a pulsed electron beam was extracted with 10^4 electrons per pulse and a polarization of 0.45 at a repetition rate of 50 s^{-1}. The scope for improvement of these figures is briefly discussed. Values for the total spin exchange collision cross section at electron energies of 1 eV, 2.5 eV and 4 eV were obtained. These are in reasonable agreement with theoretical predictions. (auth)

28573 RADIATION AND ENERGY LOSS FROM INTENSE RELATIVISTIC ELECTRON BEAMS. Mondelli, A. A. Ithaca, NY; Cornell Univ. (1972). 145p. University Microfilms Order No. 73-6663.

Thesis (Ph.D.).

A study is made of radiation and energy loss from intense, relativistic electron beams. A self-consistent calculation is given of the incoherent synchrotron emission from a relativistic electron beam propagating parallel to an applied magnetic field. The dielectric properties of the beam are included to the first order in the small parameter $(\omega_p/kc)^2$. The calculation is generalized from cylindrical to toroidal geometry, to first order in the inverse aspect ratio of the torus. For present beams the energy loss from this mechanism is only a small fraction of the available beam energy. The energy loss to synchrotron radiation from beams suitable for use in heating and confining plasma in controlled thermonuclear reactors, however, is a substantial fraction of the total beam energy. In recent experiments Nation and Gardner have monitored the microwave emission from a relativistic electron beam propagating through a background gas, and measured the spectrum associated with this radiation. Their results give strong evidence that coherent radiation is emitted from the vicinity of the beam head. To understand these experiments, we have examined a one-dimensional model of beam propagation. In the vicinity of the beam head, this model shows that the space-charge forces of the beam produce a bunching of beam electrons, the mechanism being similar to that in a reflex klystron. The coherence time computed in this model is found to be consistent with the bandwidth of the observed spectrum. The generalization of this model to three dimensions and the inclusion of a beam-created background plasma are presented and shown to be in qualitative agreement with the experiments. The fine structure in the observed spectrum is seen to be consistent with the radiation resulting from the motion of the beam electrons in their self-magnetic field. A calculation of the radiation to be expected from the passage of the beam through the anode as it enters the drift region shows a correlation between the radiated power and the time rate of change of the diode current. This correlation has also been noted experimentally. Several researchers have developed techniques for producing density-modulated relativistic electron beams in the laboratory. Such beams can resonantly interact with a mode of a background plasma to produce a rapid transfer of beam energy to the plasma. We examine the interaction between a modulated electron beam and a cold background plasma. The beam-driven fields in the plasma and the rate of energy transfer from the beam to the plasma oscillations are computed. One finds that the beam can lose a significant fraction of its initial kinetic energy in a time which is shorter than the pulse duration of typical beams available in the laboratory. (Diss. Abstr., Int., B)

28574 PRODUCTION OF BEAMS OF MULTICHARGED IONS OF METALS WITH HUGE PULSES OF A RUBY LASER. Arifov, U. A.; Arifov, T. U.; Gruich, D. D. (Inst. of Electronics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 43-46(1972). (In Russian).

The production of heavy ion beams was achieved with a ruby laser with a modulated Q and a mass spectrometer for assaying the mass and charge of the ions. The use of a target of Ti, laser radiation of power density of 3.7×10^7 watts, and a controlled magnetic field from 500 to 2000 gauss, a mass spectrogram was obtained with eight peaks which indicated that multiple charged Ti ions from Ti^{1+} to Ti^{8+} had been generated. (KSW)

Atomic and Molecular Properties

Refer also to abstracts 27768, 28608, 28957, 28974, 29052, 29059, 29060, and 29122.

28575 HYDROGEN ATOM: DYNAMICAL SYMMETRY GROUP. Boiteux, M. (Univ., Paris). Compt. Rend., Ser.B; 276: No. 1, 1-2(3 Jan 1973). (In French).

It is shown that Sp(2) is a dynamical symmetry group for the hydrogen atom in quantum mechanics. A nonlinear canonical transformation is used, which changes the initial Hamiltonian into the Hamiltonian of a four-dimensional harmonic oscillator subjected to a constraint. (France)

28576 AUGER AND OTHER CHARACTERISTIC ENERGIES IN SECONDARY ELECTRON SPECTRA FROM THIN EVAPORATED PHOSPHORUS FILMS. Melles, J. J.; Davis, L. E.; Levenson, L. L. (Univ. of Missouri, Rolla). J. Vac. Sci. Technol.; 10: No. 1, 140-143(1973).

The structure in the silicon and phosphorus Auger electron spectra (AES) for phosphorus evaporated onto a silicon substrate was studied. Similar satellite peaks were observed on the high-energy side of the silicon and phosphorus principal Auger transition. Measurements of the respective energy separations gave values lower than the silicon bulk plasmon energy. A study of the AES of phosphorus on copper did not show any repetition of the copper fine structure in the phosphorus Auger spectrum. Fine structure was observed on the silicon ionization loss peaks and was interpreted in terms of characteristic losses. These losses match those seen for the principal silicon Auger peak in size and energy. Electron binding energies, as determined from the ionization loss spectra, are reported. (auth)

28577 SURFACE AND VACUUM PHYSICS INDEX. Volume 8, No. 1, 1973. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 57p.

28578 SURFACE AND VACUUM PHYSICS INDEX. Thesaurus, 1973. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 19p.

28579 SURFACE AND VACUUM PHYSICS INDEX. Volume 8, No. 2, 1973. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 53p.

28580 RESULTS AND POSSIBILITIES IN THE DETERMINATION OF THE RYDBERG CONSTANT. Csillag, L. (Central Research Inst. of Physics, Budapest). pp 411-419 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Accurate wavelength measurements have been carried out on six lines of the Balmer series of deuterium (from D_δ to D_η) using the classic Fabry–Perot techniques with photographic recording. A high-frequency ring discharge light source was used in place of the more usual DC or AC discharge. The numerical results of the measurements are summarized in tabular form showing

the measured vacuum wave numbers, the isolated wave numbers of the $2P_{\frac{1}{2}} - nD_{\frac{3}{2}}$ (red) and $2P_{\frac{1}{2}} - nD_{\frac{5}{2}}$ (violet) components and the values of the Rydberg constant deduced from them. The weighted average of $\bar{R}_D = 109{,}707.417 \pm 0.003$ cm^{-1} is given and sources of error are discussed. New ideas for further experiments are suggested. (UK)

28581 DETERMINATION OF THE RYDBERG CONSTANT FROM THE He II n = 3–4 (4686 A) LINE COMPLEX. Kessler, E. G. (National Bureau of Standards, Washington, DC). pp 427-434 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

It has been emphasized (Taylor et al., Rev. Mod. Phys.; 41: 399 (1969)) that there is a need for a more accurate value for the Rydberg constant and to this end a redetermination is under way at NBS, based on absolute wavelengths of the best resolved fine structure components of the n ≡ 3–4 (4686 Å) transition in He II. The instrumentation for this experiment is a pressure-scanned double Fabry–Perot Spectrometer. The two separate experimental procedures used to obtain He II wavelength measurements are outlined. The value obtained so far from one procedure is $R = 109{,}737.314 \pm 0.055$ cm^{-1} representing an accuracy of 1 part in 10^7. (UK)

28582 EXCITATION-DEPENDENT CHARACTERISTICS OF H AND He II LINES USED IN DETERMINING THE RYDBERG CONSTANT. Roesler, F. L. (Univ. of Wisconsin, Madison). pp 435-443 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

The effects different excitation techniques can have on the appearance of H and He II lines used in determining the Rydberg constant are discussed. The effects are of concern in measuring the Rydberg constant because the complicated fine structures of hydrogen-like lines are not fully resolved; and knowledge of the relative intensities and widths of the components is necessary for most satisfactory correction for blending. It would also be advantageous if a method for producing very narrow hydrogen-like lines could be discovered, but experiments have so far been unsuccessful. (UK)

28583 ATOMIC FIELD EQUATIONS FOR MAXWELL FIELDS INTERACTING WITH NON-RELATIVISTIC QUANTAL SOURCES. Babiker, M. (Univ. of Sussex, Brighton, Eng.); Power, E. A.; Thirunamachandran, T. Proc. Roy. Soc. (London), Ser. A; 332: No. 1589, 187-197 (6 Mar 1973).

The microscopic field equations of electromagnetism interacting with a many-particle Schroedinger field of charged particles are shown to be exactly equivalent to the atomic field equations where the sources are free electron and ion charge densities and convective and Roentgen current densities only. The fields are now the microscopic displacement vector d and the microscopic auxiliary field h and their relation to the electric and magnetic fields e and b are given exactly in terms of polarization and magnetization vectors without reference to any multipolar expansions. The values of the polarization fields are calculated for several transitions in atomic hydrogen to illustrate the connection with the usual multipole expansions. (auth)

28584 TEMPERATURE DETERMINATION FROM THE RELATIVE LINE-TO-CONTINUUM INTENSITY OF THE He II 4686 AND 3203 LINES. Delcroix, A.; Volonte, S. (Univ., Mons, Belgium). J. Phys., B (London); 6: No. 1, L4-L7 (Jan 1973).

Calculations of the temperature sensitive line-to-continuum intensity ratio of the He II 4686 and 3203 lines are presented for the temperature range below 80,000°K where a density dependence sets in. When electron density is such that partial LTE holds, the method provides very accurate temperature measurements. The effect of small hydrogen admixtures is also outlined. (auth)

28585 DISSOCIATION OF 10 keV HeH^+ MOLECULAR IONS. IV. Rotational Predissociation of the $X^1\Sigma$ State. Schopman, J.; Fournier, P. G.; Los, J. (FOM-Instituut voor Atoom- en Molecuulfysica, Amsterdam). Physica; 63: No. 3, 518-526 (1 Feb 1973).

Measurements on the spontaneous and collision-induced dissociation are presented for the isotopic molecules $^4HeH^+$, $^3HeH^+$, $^4HeD^+$ and $^3HeD^+$. In all cases however though less developed in $^3HeD^+$, sharp peaks are observed in agreement with earlier observations in $^4HeH^+$. These peaks are attributed to rotational predissociation of the molecule. The quasibound states are formed in the ionization chamber in the case of spontaneous dissociation and by excitation from stable lower-lying states for the collision-induced contributions. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

28586 THEORETICAL VALUE OF POSITRONIUM GROUND STATE SPLITTING. Barbieri, R. (Scuola Normale Superiore, Pisa, Italy); Christillin, P.; Remiddi, E. Phys. Lett.; 43B: No. 5, 411-412 (5 Mar 1973).

The contribution to the triplet-singlet splitting of positronium ground state arising from fourth-order vacuum polarization in the annihilation channel is reported. It is found to be $\Delta\nu = \alpha^2\,\mathrm{Ry}_\infty\,[-(\frac{1}{4})\,\alpha^2 \ln \alpha^{-1}]$. (auth)

28587 MUONIUM HFS SPLITTING AS A SOURCE OF α. Favart, D.; McIntyre, P. M.; Stowell, D. Y.; Swanson, R. A.; Telegdi, V. L.; DeVoe, R. (Univ. of Chicago). pp 373-378 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

The information concerning α which one can derive, both in principle and in practice, from precision measurements of the hyperfine splitting, $\Delta\nu$, of muonium is reviewed. A novel technique for measuring $\Delta\nu$ to high accuracy which has been developed at Chicago is described. (UK)

28588 CORRECTION OF μ-MESIC ENERGY LEVELS FOR NUCLEAR POLARIZATION IN THE ADIABATIC APPROXIMATION. Petrun'kin, V. A.; Startsev, S. A. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 16: No. 11, 443-445 (5 Dec 1972).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 16: No. 11, 628-631 (5 Dec 1972).

It is noted that the dipole-polarization correction to the energy of the μ-mesic atomic levels with $l > 1$, = 1 can be calculated with the aid of an adiabatic approximation by using the potential for the polarization interaction between the muon and the nucleus. It can be shown rigorously that for not too heavy nuclei, with the orbit of the muon lying outside the nuclei, the characteristic energy 10 to 20 MeV of the nuclear dipole transition is much higher than the characteristic energy of the μ-mesic atomic transitions. The polarizability corrections to the energies of the S, P, and D levels of the μ-mesic atoms of neon-20, calcium-40, and lead-208 are given. (JFP)

Collision Phenomena

28589 (FRNC-TH-316) STUDY OF IONIZATION PROCESSES IN METALLIC VAPORS AT HIGH TEMPERATURES USING MASS SPECTROMETRY. Cabaud, B. (Lyon Univ. (France)). 1972. 177p. (In French). Dep. NTIS (U. S. Sales Only) $11.00.

Thesis.

Metallic vapors were chemically analyzed using mass spectrometry. The advantages of the simultaneous utilization of thermodynamic calculations effected from measurements made of the partial pressures with a Knudsen gage and the results of experiments on the ionization of a molecular jet by electron impact are outlined. Studies of the fine structure of the metallic vapor ionization efficiency curves for a molecular jet established the effect of temperature on the structure of these curves. It was demonstrated that autoionization processes play an important role in the ionization of these vapors. It was thus possible to measure the ionization potential of Ag_2, Cu_2, and Au_2 molecules and to demonstrate the advantages of the equipment used for the study of diatomic and polyatomic molecules of antimony and bismuth. (France)

28590 (FRNC-TH-349) ABSOLUTE MEASUREMENT OF TOTAL CAPTURE ELECTRON LOSS, AND DISSOCIATION CROSS SECTIONS FOR H_1^+, H_2^+, AND H_3^+ IONS COLLIDING WITH A WATER VAPOR TARGET; ENERGY SPECTRA OF THE CHARGED FRAGMENT PRODUCED. Dagnac, R. (Toulouse Univ. (France)). 1972. 139p. (In French). Dep. NTIS (U. S. Sales Only) $9.00.

Thesis.

Collisions between H_1^+, H_2^+, H_3^+ ions having energies lying between 2 and 50 keV and water vapor molecules were experimentally studied. The total capture, electron loss, and dissociation cross sections were measured. An experimental arrangement used to

determine the energy loss of ions colliding with rare gas atoms is described. (France)

28591 X-RAY EMISSION OF HIGHLY STRIPPED IONS. Betz, H. D.; Schnopper, H. W. (Massachusetts Inst. of Tech., Cambridge). J. Phys. (Paris), Colloq.; No. 5, 116(1972).

Targets with atomic numbers from 6 to 92 were bombarded with ions of chlorine, bromine, and iodine at energies up to 156 MeV, and the x-ray spectra obtained were studied. (FR)

28592 EXCITATION OF THE Na 3p STATE BY MONOCHROMATIZED ELECTRONS. Hafner, H. (Univ., Tuebingen, Ger.). Phys. Lett.; 43A: No. 3, 275-276(12 Mar 1973).

The relative differential cross section for the electron impact excitation of the unresolved sodium D lines was measured with a monochromatized electron beam. (auth)

28593 X-RAY PRODUCTIONS IN SYMMETRIC HEAVY ION-ATOM COLLISIONS. Tawara, H.; Foster, C.; De Heer, F. J. (FOM-Instituut voor Atoom- en Molecuulfysica, Amsterdam). Phys. Lett.; 43A: No. 3, 266-268(12 Mar 1973).

X-ray measurements for 50 to 200 keV impact $Ne^+ \rightarrow Ne$, $Ar^+ \rightarrow Ar$ and $Kr^+ \rightarrow Kr$ show an increase of a factor of 10 in the fluorescence yield for $Ar-L_{23}$, a similar increase may occur for $Kr-M_{23}$, but for Ne-K the yield does not vary much. (auth)

28594 TOTAL ELASTIC SCATTERING CROSS SECTION OF POTASSIUM IONS BY ARGON ATOMS. Palyukh, B. M.; Chigin, V. I. (Lvov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 17: No. 12, 2061-2063(Dec 1972). (In Russian).

The apparatus for studying the elastic scattering of K ions is described. The ion source was a W spiral coated with the K aluminosilicate $K_2CO_3 \cdot Al_2O_3 \cdot 4SiO_2$. The total elastic scattering cross section of K^- ions by Ar atoms was determined as a function of the energy of the ions from 6 to 100 eV. The results were compared with those of other workers which encompassed the energy range from 0 to 1,000 eV. (KSW)

28595 COMPARISON OF THE WKB AND PURELY CLASSICAL METHODS FOR VIBRATIONAL TRANSITION PROBABILITIES. Shin, H. K. (Univ. of Nevada, Reno). Chem. Phys. Lett.; 18: No. 3, 359-364(1 Feb 1973).

A rigorous comparison of the WKB evaluation of the quantal approach, P_{WKB}, with the purely classical theory, P_C, of vibrational energy transfer is presented. For the Lennard-Jones (12-6) potential, $P_C \approx (7/6)\,[\Gamma(6/7)]^{-2}\,P_{WKB}$, when the collision energy is appropriately symmetrized. The first two terms in the exponent of P_{WKB} are identical to those of P_C. For the (m-6) potential, the relation is $P_C \approx [(m+2)/m]\,\{\Gamma[m/(m+2)]\}^{-2}\,P_{WKB}$, which shows that $P_C \approx P_{WKB}$ for $n \gg 2$. For exponential potentials, $P_{WKB} = P_C$. In the WKB approach the perturbation integral is evaluated at "the most probable distance for the transition," while in the classical approach the Fourier integral is evaluated by use of the trajectory determined in the immediate neighborhood of the pole. Both the most probable distance and the pole lie in the region of strong repulsive interaction. (auth)

28596 CONSTRUCTION OF A NONLOCAL POTENTIAL FROM THE SCATTERING AMPLITUDE IN THE BORN APPROXIMATION. Gerber, R. B. (Weizmann Inst. of Science, Rehovot, Israel). Chem. Phys. Lett.; 18: No. 3, 436-440(1 Feb 1973).

Within a framework of the Born approximation simplified by certain assumptions, a procedure is given which explicitly constructs a nonlocal potential that provides a fit to elastic scattering data. The data are assumed to consist of the scattering amplitude as a function of the momentum transfer over a finite range of energies. The constructed potential is unique only when the kernel of the nonlocal interaction is energy independent, or when its explicit energy dependence is known from information other than scattering data. (auth)

28597 OBSERVATION OF THE ATOMIC RAMSAUER-TOWNSEND EFFECT IN ^4He-^4He SCATTERING. Aufm Kampe, W.; Oates, D. E.; Schrader, W.; Bennewitz, H. G. (Univ., Bonn). Chem. Phys. Lett.; 18: No. 3, 323-324(1 Feb 1973).

Measurements of the total scattering cross section for ^4He-^4He at very low energies are presented. The measurements have resolved the atomic Ramsauer-Townsend effect. (auth)

28598 M-SHELL PHOTOELECTRIC CROSS-SECTIONS IN HIGH Z ELEMENTS. Parthasaradhi, K. (Andhra Univ., Waltair, India). Vishwakarma; 12: No. 5, 29-30(1971).

Total M-shell photoelectric cross sections are estimated in the elements W, Au, Pb and U and the results with a discussion in the light of the recent theoretical values are presented. (auth)

28599 COHERENT EXCITATION OF ATOMS PASSING THROUGH A CRYSTAL. Okorokov, V. V.; Tolchenkov, D. L.; Khizhnyakov, I. S.; (and others) (Inst. of Theoretical and Experimental Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 16: No. 11, 415-417(5 Dec 1972).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 16: No. 11, 588-592(5 Dec 1972).

The coherent excitation of He^+ ions passing through a single-crystal silver film is studied. The intensity of the 4685 Å line at incident energy near 570 keV is plotted. (JFP)

28600 MODIFICATION OF THE VARIATION-OF-PARAMETERS METHOD AND INTEGRATION OF THE SCHROEDINGER EQUATION. Tani, S. (Marquette Univ., Milwaukee); Inokuti, M. J. Comput. Phys.; 11: No. 3, 409-422(Mar 1973).

In the ordinary method of variation of parameters, a solution of a given linear differential equation is assumed to be a linear combination of independent solutions of an auxiliary solvable equation, and the coefficients in that linear combination are functions to be determined. A new version presented uses a linear combination including also the first derivative of the solution of an auxiliary equation. We have applied this method successfully to the stepwise numerical integration of the partial-wave Schrödinger equation in scattering theory. Since higher-order terms in a power-series solution can be included rather straightforwardly, the new method achieves high accuracy even when the step size is appreciably large. A numerical example is presented. (auth)

28601 ARGON L X-RAY SPECTRA FROM COLLISIONS OF ARGON IONS WITH VARIOUS SOLID-STATE TARGETS. Panke, H.; Bell, F. (Univ., Munich). Phys. Lett., 43A: No. 4, 351-352(26 Mar 1973).

Spectral measurements have been made of Ar-L-shell x-rays produced by Ar ions incident on various solid state targets. Different spectra have been observed for targets with $Z < 18$ and $Z > 18$ respectively. The data are discussed within the framework of the electron promotion model of Barat and Lichten. (auth)

28602 PROGRAM FOR EVALUATION OF NON-EXCHANGE TYPE INTEGRALS REQUIRED IN ELECTRON-ATOM SCATTERING THEORY USING SLATER-TYPE ORBITALS AS BASIS FUNCTIONS. Smith, R. L.; Truhlar, D. G. (Univ. of Minnesota, Minneapolis). Comput. Phys. Commun.; 5: No. 1, 80-87(Jan 1973).

The computer program NETI written in FORTRAN IV for the CDC 6600 computer is described for the computation of five basic integrals in terms of which all the nonexchange-type integrals which are needed in calculations for electron scattering by atoms. (JFP)

28603 EXCITATION OF RUBIDIUM IONS IN THERMAL COLLISIONS WITH METASTABLE HELIUM ATOMS. Gudkov, A. A.; Kravchenko, V. F.; Papakin, V. F. (Rostov State Univ., USSR). JETP Lett. (USSR) (Engl. Transl.); 17: No. 1, 11-13(5 Jan 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 1, 17-19(5 Jan 1973).

By studying the afterglow of a pulsed gas discharge in a mixture of rubidium vapor with helium, the existence of an effective excitation of a number of levels of the 5p configuration of the ion Rb II, as a result of energy transfer in the collisions of metastable helium atoms with rubidium ions in the ground state, was established. A lower bound for the effective cross section of the processes was found. (JFP)

Atomic Theory

Refer also to abstracts 27694, 28580, 28581, 28587, 29052, and 29429.

28604 FREQUENCY SHIFTS IN EMISSION AND ABSORPTION BY RESONANT SYSTEMS OF TWO-LEVEL ATOMS. Friedberg, R. (Columbia Univ., New York); Hartmann, S. R.; Manassah, J. T. Phys. Rep.; 7C: No. 3, 101-179(Mar 1973).

The frequency shifts in emission and absorption arising from resonant many-body interactions in a system of two-level atoms are discussed from several points of view: in the language of superradiance, Dicke states, quantum electrodynamics, and perterbation theory; in the classical-path treatment of gaseous emission, with emphasis on the impact approximation; by means of diagrams related to the temperature-Green's function formalism; in the semiclassical model using the macroscopic Bloch vector; and through ordinary classical electromagnetic theory in a linear medium. (auth)

28605 TWO-LEVEL ATOM IN CLASSICAL SINUSOIDAL FIELD. Swain, S. (Queen's Univ., Belfast). Phys. Lett.; 43A: No. 3, 229-230(12 Mar 1973).

Formally exact solutions to the Schroedinger equation describing the interaction of a two-level atom with a classical sinusoidal field are presented. The solutions are derived on the basis of the Floquet theorem. (auth)

28606 PHYSICAL CHEMISTRY. SERIES ONE. VOLUME 1. THEORETICAL CHEMISTRY. Brown, W. B. (ed.). MTP International Review of Science. Baltimore; University Park Press (1972). 301p. $24.50.

The topics discussed cover electron correlation in atoms, the calculation of energy quantities for diatomic molecules, intermolecular forces, molecular properties, statistical thermodynamics of liquids, molecular collisions and reactive scattering, and transport theory and its application to liquids. (JFP)

28607 REVIEW OF SPECTROSCOPIC DATA FOR DETERMINING THE FINE STRUCTURE CONSTANT. Lea, K. R. (Yale Univ., New Haven). pp 355-372 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The Sommerfield fine structure constant, α, has long been measured by optical spectroscopy methods, which in turn gave way to microwave spectroscopy as the necessary techniques were developed. Recently the Lamb shift, the fine structure intervals, the hyperfine structure interval, the "anomalous" magnetic moment, the ac Josephson effect, the rotating superconducting junction and the measurement of the Compton wavelength of the electron have all been used in measurements of α. The first three items are considered in some detail. (UK)

28608 NEW MEASUREMENT OF THE RYDBERG. Kibble, B. P. (National Physical Lab., Teddington, Eng.); Rowley, W. R. C.; Series, G. W. pp 420-426 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Although past determinations on which the present value of the Rydberg is based show a remarkable agreement, possible systematic errors have caused the accuracy to be questioned. These sources of error are the following: unresolved blends of fine structure components were measured, wavelength standards other than the krypton-86 606 nm primary standard were used, the signal/noise and linearity of the intensity scale in the interferograms were poor because of the photographic techniques used, the possible inequality of light flux distribution through the interferometer between light of the different wavelengths to be compared was not discussed, and in some cases there was no mention of the differing phase change at the reflecting surfaces of the interferometer for the two wavelengths to be compared. A redetermination of the constant is described in which particular attention was paid to these points. From a preliminary measurement of the interferograms it is concluded that these results with deuterium do not conflict with the value of the Rydberg quoted by Taylor et al. in their review of values of the fundamental constants. The results with tritium are discrepant, but this may well be due to contamination of the sample with hydrogen. (UK)

28609 PHYSICAL CHEMISTRY. Series One. Volume 2. Molecular Structure and Properties. Allen, G. (ed.). MTP international review of science. Baltimore; University Park Press (1972). 270p. $24.50.

The topics covered are techniques and uses of infrared refractivity, neutron diffraction studies of molecular structures, structure of crystalline polymers, magnetic susceptibilities of diamagnetic molecules, acoustic studies of molecular conformational changes, gas electron diffraction, and the theory of dielectric polarization. (JFP)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

28610 MAGNETOHYDRODYNAMIC APPROXIMATION FOR THE DOUBLE-TIME GREEN'S FUNCTIONS OF A CONDUCTING FLUID IN A MAGNETIC FIELD. Mezincescu, G. A. (Univ., Bucharest). Rev. Roum. Phys.; 17: No. 5, 535-539(1972).

Asymptotic expressions, valid in the limit of small ω, k, for the double-time classical Green's functions of a one-component conducting fluid in a magnetic field are obtained from the Navier–Stokes magnetohydrodynamics equation. (auth)

28611 RELATIVISTIC MAGNETOHYDRODYNAMICS OF A ROTATING PLASMA. Ciubotariu, C. D. (Polytechnic Inst., Iasi); Gottlieb, J. Physica; 63: No. 2, 393-403(15 Jan 1973).

The tetrad formulation of relativistic magnetohydrodynamics is obtained with respect to a nonholonomic tetrad field. This is used for the study of a system composed of a rotating plasma coupled to a frozen-in magnetic field. It is found that a homogeneous magnetic field influences the pressure of the plasma only in the case where the magnetic field is collinear to the second space-like four-vector of the tetrad. The assumption of a small perturbation leads us to the conclusion that the longitudinal sound waves and the Alfvén waves move slower in the rotating plasma than in a rest plasma. Finally, a physical significance of tetrad components of the torsion of space–time is found. (auth)

28612 MAGNETIC BOUNDARY LAYER THEORY. Lal, K. (Banaras Hindu Univ., India). Indian J. Phys.; 46: No. 9, 393-404(Sep 1972).

The laminar unsteady magnetic boundary layer equations were discussed for the two variable suction velocity cases when (i) unsteady part of suction velocity contains one term and (ii) unsteady part of suction velocity is expanded in series having n terms, and in both the cases the suction velocity becomes constant by putting the parameter A equal to zero. The expression for the velocity distribution inside the boundary layer has been deduced and from it the skin-friction at the wall calculated and discussed graphically for large range of values A and frequency of oscillations such as $\omega = 1, 2, 3, 4$. It has been shown, for one numerical example, that the velocity distribution inside the boundary layer decreases for small frequency of oscillation and increases for large frequency of oscillation as the unsteady suction velocity increases. (auth)

28613 NOTE ON RAYLEIGH'S PROBLEM IN MAGNETOHYDRODYNAMICS. Pop, I. Appl. Mech. Rev.; 25: No. 10, 1274(Oct 1972).

From Bollettino dell'Unione Matematica Italiana 4: No. 6, 912-917(Dec 1971).

The unsteady incompressible flow caused by a wall set suddenly in constant speed motion was treated previously for various special cases of wall conductance and ratio α of magnetic and viscous Reynolds numbers. The case of a nonconducting nonmagnetic wall and $\alpha > 1$ is dealt with here. A similarity solution is found for the velocity u and magnetic field H distribution as a function of time with α and the Alfven number β as the parameters by approximating u and H through second-order power series in time. Six simultaneous ordinary differential equations are to be solved finally, showing that—as one would expect—the flow behaves initially as if the viscous and the magnetic diffusion layers were independent of each other. The dimensionless skin friction is given as a second-order power series in βt. Since the functions of α forming the coefficients of this series are given in analytical form, their incorrect graphical representation cannot create a difficulty in using the series. An up-to-date bibliography is given that should be of interest to workers in the area of unsteady magnetohydrodynamic boundary-layer flow. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

28614 (FRNC-R-16, pp 151-175) SURVEY OF EXPERIMENTAL PROPOSALS AT N.A.L. Matsuda, S. (CERN, Geneva). 1972.

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

The experimental proposals made at NAL are briefly surveyed and analyzed from the physics point of view: hadron interactions and photon interactions including photon–hadron interactions as well as photon-mediated reactions. In the field of quantum electrodynamics, an essentially complete theory is available. Verifications of the theory in all experiments ranging from the Lamb shift (accuracies of 10^{-10} eV being obtained) to QED interactions at several GeV, interaction energies and momentum transfers are presented. No satisfactory theory is yet available in the field of hadron and weak interactions which is self-consistent and explains the data. (France)

28615 NOVEL TYPE OF INTERACTION NEAR 10^4 GeV. Baruch, J. E. F.; Brooke, G.; Kellermann, E. W. (Univ. of Leeds, Eng.). Nature (London) Phys. Sci.; 242: No. 114, 6-7(5 Mar 1973).

Cosmic ray data obtained with a single interaction calorimeter at the Haverah Park array, 240m above sea level, are presented. Details are given of the apparatus used and technique adopted. Analysis showed the possibility of a "novel" type of interaction near 10^4 GeV. (UK)

28616 SEARCH FOR THE QUARK IN EXTENSIVE AIR SHOWERS, USING A COUNTER-CONTROLLED CLOUD CHAMBER. Evans, G. R. (Univ. of Edinburgh); Fancey, N. E.; Muir, J.; Watson, A. A. Proc. Roy. Soc. Edinburgh, Sect. A; 70: 143-153 (1972).

A search is reported for the relativistic e/3 quark among the cores of extensive air showers initiated by primaries with energies greater than 10^{14} eV. The detector is a high-pressure cloud chamber filled with helium at 28 atmospheres, and is counter controlled. The experimental conditions avoid the criticisms levelled at the McCusker experiment (Phys. Rev. Lett.; 23: 658 (1969)) and are such that the tracks of e/3 quarks cannot be simulated by singly charged shower particles either through statistical variations in primary ionization or otherwise. The primary ionization density, measured using a gap-counting technique on post-expansion electron and muon tracks, is compared with predictions from the theory of Budini et al. (Nuovo Cimento; 18: 864(1960)). The agreement acheived shows that the theory is a reliable foundation for methods of identifying quark candidates, and measuring charges. The experiment has been running for 5000 hours. No quark candidates have been found. With an acceptance angle of 0.3 sr and an area of 140 cm^2, this sets the upper limit of flux of e/3 quarks at 4×10^{-9} cm^{-2} sec^{-1} sr^{-1} with 95% confidence. The experiment is being continued. (auth)

28617 EXPERIMENTAL SURVEY OF DIFFRACTION DISSOCIATION PROCESSES. Otter, G. (Institut fuer Hochenergiephysik, Vienna). Acta Phys. Austr., Suppl.; No. 9, 378-462(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

A review is given of new results published during 1971 on diffraction dissociation processes. The idea of Good and Walker, definition of diffractive processes, mass cuts, LPS method, and isospin analysis for separation of diffractive reactions, the various diffractive reactions, factorization properties, the Gribov–Morrison and Carlitz–Frautschi–Zweig rules, and helicity conservation are covered. (JFP)

Electromagnetic

Refer also to abstracts 27694, 28607, 28749, 28903, 29052, and 29429.

28618 (CONF-720582–) PROCEEDINGS OF THE INFORMAL MEETING ON ELECTROMAGNETIC INTERACTIONS, FRASCATI, MAY 2–3, 1972. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 1972. 114p.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

Separate abstracts were prepared for 10 of the 11 papers presented. The other paper previously appeared in NSA as 26: 51591. (CES)

For abstracts of individual papers see: 28409, 28619–28622, 28643, 28721–28723, and 28821.

28619 (CONF-720582–, pp 19-31) RESULTS ON MULTIHADRONIC PRODUCTION IN e^+e^- COLLISIONS AT TOTAL C. M. ENERGIES 2E > 1.2 GeV. Mencuccini, C. (CNEN, Frascati, Italy). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

A review is given on $e^+ + e^-$ many hadrons interaction cross sections above 1.2 GeV in colliding beams using counters and spark chambers. (JFP)

28620 (CONF-720582–, pp 33-42). TWO BODY PRODUCTION IN e^+e^- COLLISIONS. Vitale, S. (Univ., Naples). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

Research at Adone on two body hadronic processes in $e^+ + e^-$ collisions is summarized. The region between 1.4 and 2.4 GeV cm is considered. (JFP)

28621 (CONF-720582–, pp 51-57) TWO-PHOTON ANNIHILATION. Murtas, G. P. (CNEN, Frascati, Italy). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

A review is given of experimental research on two-photon processes in colliding beams $e^+ + e^- \rightarrow e^+ + e^- + 2\gamma \rightarrow e^+ + e^-$ + lepton state (hadron state). (JFP)

28622 (CONF-720582–, pp 85-100) ANOMALOUS ELECTROMAGNETIC CURRENTS (EXPERIMENTAL). Susinno, G. (CNEN, Frascati, Italy). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

The present experimental situation concerning anomalous electromagnetic currents in the $\gamma + n \rightarrow p + \pi^-$ interaction is reviewed. (JFP)

28623 (FRNC-R-16) COLLOQUIUM OF THE HIGH ENERGY DIVISION, AUSSOIS, FRANCE, 20–24 MARCH 1972. (Paris Univ., Orsay (France). Institut de Physique Nucleaire). 1972. 185p. (In French and English). (CONF-720344–). Dep. NTIS (U. S. Sales Only).

The subjects developed during the Colloquium principally concern very high energy physics: ISR and 300 GeV energies at CERN and 300 GeV at NAL. Weak interactions, electromagnetic interactions and strong interactions were considered. Eight papers were presented and all of them have been abstracted for NSA. (FR)

For abstracts of individual papers see: 27707, 28614, 28644–28646, 28650, 28671, and 28762.

28624 (LA-UR-73-424) PHOTODISINTEGRATION OF THE TRINUCLEONS. Gibson, B. F. (Los Alamos Scientific Lab., N. Mex.). Mar 1973. Contract W-7405-eng-36. 12p. (CONF-730301-3). Dep. NTIS $3.00.

From international conference on photonuclear reactions and applications; Pacific Grove, California, USA (26 Mar 1973).

A brief review of the experimental and theoretical status of the problem of the electromagnetic interactions with the trinucleon system is presented. Elastic and inelastic electron scattering as well as two-body and three-body photodisintegration are covered in some detail. Binding energy calculations and sum rule results (σ_{-1}) are discussed and a brief introduction to the related weak interaction problem is included. (auth)

28625 (LAL-1264) MEASUREMENT OF ELECTRON–DEUTERON SCATTERING CROSS SECTIONS FOR TRANSFERS BETWEEN 0.5 AND 6 fm^{-1}. Ganichot, D. (Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire). Jul 1972. 28p. (In French). Dep. NTIS (U. S. Sales Only) $3.50.

Thesis.

The transverse terms of electron–deuteron scattering cross sections were determined from measurements made of electrons scattered at 180°. Theory and experiment were compared, the spectrum corresponding to a given theoretical model was calculated. In this way it was possible to perform the experiment in spite of very unfavorable experimental conditions. In the case of electrodisintegration near the threshold, the measurements enabled experiments at low transfer (<1 fm^{-2}) to be related to

those having transfers in excess of 5 fm^{-2}. The validity of the nonrelativistic scattering theory was thus confirmed. (France)

28626 (UCSB-10-P-23-18) HIGH ENERGY USER GROUP AT SANTA BARBARA. Progress Report for the Period May 1972 to March 1973. Caldwell, D. O. (California Univ., Santa Barbara). 1972. Contract AT(11-1)-Gen-10. 12p. Dep. NTIS $3.00.

Experimental research on electromagnetic interactions is summarized. A list of publications is included. (JFP)

28627 MEASUREMENT OF INCLUSIVE PHOTOPRODUCTION AT 3.2 GeV AND COMPARISON WITH ELECTROPRODUCTION. Burfeindt, H.; Buschhorn, G.; Genzel, H.; Heide, P.; Koetz, U.; Mess, K. H.; Schmueser, P.; Sonne, B.; Vogel, G.; Wilk, B. H. (DESY Hamburg). Phys. Lett.; 43B: No. 4, 345-348(19 Feb 1973).

Inclusive photoproduction cross sections for pions, kaons, and protons have been measured in the photon fragmentation region and are compared with recent electroproduction data at $q^2 = 1.16$ $(GeV/c)^2$. If the cross sections are normalized to the total hadronic cross sections at $q^2 = 0$ and $q^2 = 1.16$ $(GeV/c)^2$, respectively, we observe that more pions, about an equal number of protons, but fewer kaons are found in the photoproduction case for $x \geq 0.3$. (auth)

28628 RECENT NPL WORK ON μ_p/μ_N. Petley, B. W.; Morris, K. (National Physical Lab., Teddington, Eng.). pp 445-450 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The cyclotron resonance curve in the NPL quadrupole omegatron was scanned by varying the applied radio frequency and keeping the magnetic field constant. This enabled a number of small systematic effects to be investigated with a greater precision than hitherto. Confidence in the omegatron method has been increased considerably, and it appears that the cyclotron frequency can be defined meaningfully to better than one hertz when the magnetic flux density is 1.4 T. The D_2–^4He mass difference has also been measured. (auth)

28629 NEW DETERMINATION OF THE MAGNETIC MOMENT OF PROTON IN THE UNITS OF NUCLEAR MAGNETON. Mamyrin, B. A.; Aru'ev, N. N.; Alekseenko, S. A. (Ioffe Inst. of Physics and Tech., Leningrad). pp 451-456 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

All known methods of μ_p/μ_n determination include two sources of error, the ion trajectory change caused by magnetic field inhomogeneities and changes caused by stray electric fields in the ion drift space. The first error was corrected in previous work by use of the magnetic resonance mass spectrometer, but correction for the second is only useful if the distribution of the field is the same when the cyclotron frequency of ions of different e/m are being measured. By using a secondary electron multiplier it was possible to use a very small ion current. The new technique consists of the fact that the ion source does not require re-adjustment for ions of different e/m and the whole pattern of the ion beams leaving the ion source remains invariable. Other sources of error are considered and the results tabulated. The average of all runs of measurements without correction for the diamagnetism of water gave a value of μ_p/μ_n of 2.7927745. (UK)

28630 GYROMAGNETIC RATIO OF THE PROTON. Progress with the NPL Weak-Field Apparatus. Vigoureaux, P. (National Physical Lab., Teddington, Eng.). pp 457-461 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The weak-field NPL apparatus for determining the gyromagnetic ratio of the proton and for checking the ampere as maintained by the Laboratory standard resistors and Weston cells is described. The steady part of the ambient flux density, the variation of ambient flux density and the gradients of magnetic flux density are considered. Although measurements made so far have not been undertaken with strictest care (as the machine built to measure the linear dimensions of the coils is undergoing tests), the results, based on nominal dimensions of the field-forming coils and on an assumed coefficient of linear expansion for silica of 0.4×10^{-6}/K, have, however, been promising. The five results obtained lie within 1.6 in 10^6; and four of them, within 0.6 in 10^6. The results of precession frequency obtained hitherto and the work already done on the measuring machine suggest that, apart from uncertainty in the knowledge of the ampere, the gyromagnetic ratio of the proton can be determined with a probable uncertainty (50% confidence) of not more than 1 in 10^6. (UK)

28631 MICS FOR γ_p' DETERMINATION. Hara, K.; Nakamura, H. (Electrochemical Lab., Tokyo). pp 462-470 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A Magnetically Isolated Calculable Solenoid (MICS) may eliminate the difficulty experienced when using a single-layer solenoid of finding a non-magnetic environment where the earth's field is sufficiently uniform and quiet. Such equipment is now under construction at the Electrotechnical Laboratory, Tokyo, and a brief explanation of its principle and a discussion of its practical problems are given. The effect of the hysteresis and nonlinearity of the shielding material on the equipment is discussed on the basis of the magnetic circuit approximation. It is found both of them have little effect on the H_+ field as long as the shielding material is uniform. The magnetic circuit approximation in this case gives a rather good picture of the reproducibility of the field, because in an MICS leakage flux is small and hence reluctances are well defined. The residual field due to the residual mmf may be the worst effect. If the residual field is uniform enough to generate a precessional signal, polarity reversal of the main solenoid together with the compensation pair may eliminate the effect. (UK)

28632 DETERMINATION OF γ_p' AT THE NATIONAL BUREAU OF STANDARDS. Olsen, P. T.; Driscoll, R. L. (National Bureau of Standards, Washington, DC). pp 471-484 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The precision of γ_p' measurements at the National Bureau of Standards (NBS) has improved significantly since the early measurements of the 1950's, from several parts per million (ppm) to the present 0.1 to 0.2 ppm. Current efforts are now being directed towards improving the present 3 to 4 ppm accuracy of the experiment by an order of magnitude. The progress being made in this direction is reported. A general discussion of the experiment is given, including the use of the method of nuclear induction to determine the precession frequency, a description of a new and improved series of pitch measurements using a laser interferometer, a discussion of the effect of the change in original winding tension on the effective diameter of the windings, and an analysis of the effect of the finite susceptibility of the solenoid and water sample support structure on the calculated magnetic field. All of the known corrections to the field are summarized and a brief analysis of the uncertainties in the experiment is given. The result of the preliminary work reported is $\gamma_p' = 2.67513523 \times 10^8$ rad s^{-1}/T_{NBS}. (UK)

28633 g-FACTOR ANOMALIES OF THE ELECTRON AND POSITRON. Wesley, J.; Rich, A. (Univ. of Michigan, Ann Arbor). pp 485-503 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Recent work on the electron and positron g factor anomalies is summarized. The latest developments in the calculation of the 6th-order coefficient are considered. Two types of experimental techniques are discussed: The precession technique involves a direct observation of the spin precession of polarized leptons in a static magnetic field. The resonance technique is characterised by the presence of an oscillating electromagnetic field that induces transitions between the energy levels of an electron in static electric and magnetic fields. Potential for future progress in the field is assessed. (UK)

28634 PRECISE MEASUREMENT OF THE ANOMALOUS MAGNETIC MOMENT OF THE MUON. Farley, F. J. M. (Royal Military Coll. of Science, Shrivenham, Eng.). pp 504-508 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.), London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

An experiment carried out at CERN to determine the gyromagnetic ratio g_μ of the muon, (and hence its magnetic moment), to

±0.3 parts per million (ppm) is described. The spin–spin interaction of the muon and electron in muonium is considered. Here the hyperfine structure splitting is proportional to $g_\mu \alpha^2$ so an accurate knowledge of g_μ is essential for a determination of α by this method. The experiment also establishes that the muon is a point-like particle, obeying the standard quantum-electrodynamics, and that it has no extra detectable interaction or structure which might perturb the energy levels in muonium. (UK)

28635 $\omega-\rho$ INTERFERENCE IN THE TWO PION DECAY MODE IN DIFFRACTIVE PHOTOPRODUCTION FROM COMPLEX NUCLEI. Behrend, H. J. (Univ. of Rochester, NY); Lee, C. K.; Lobkowicz, F.; (and others). pp 133-138 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

The interference of ρ_0 and ω in the 2π decay mode was observed in diffractive photoproduction off complex nuclei. The resulting branching ratio $\omega \to 2\pi/\omega \to 3\pi$ is 2.8 ± 0.6%, the difference in the decay phases $(\omega \to 2\pi) - (\rho \to 2\pi)$ is 63 ± 16%. (auth)

28636 MEASUREMENT OF THE RADIATIVE DECAY MODES OF THE φ MESON, $\varphi \to \eta\gamma$, $\varphi \to \pi^0\gamma$ WITH THE ORSAY STORAGE RING. Benaksas, D.; Cosme, G.; Jean-Marie, B.; (and others) (Ecole Normale Superieure, Orsay, France). pp 235-243 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

A large solid angle detector was used to observe many-body final states in the decays of the φ meson. In the decay modes $\varphi \to \eta\gamma$ and $\varphi \to \pi^0\gamma$, 3γ was detected. The data were taken at the peak of the φ and the normalization is given by Bhabha scattering. The values found are $B_{\varphi\to\eta^0\gamma/\varphi\to all} = 0.0192 \pm 0.0057$, and $B_{\varphi\to\pi^0\gamma/\varphi\to all} = 0.0019 \pm 0.0008$. A measurement of neutral branching ratios of the φ, namely $\varphi \to \eta\gamma$ and $\varphi \to \pi^0\gamma$ is presented. Results were obtained from the whole of the data at the top of the φ resonance. The events coming from e^+e^- collisions with 3γ rays in the final state were measured. Bhabha events were used to normalize the results from the total cross sections obtained in the previous experiments. The apparatus is the same as the one described by G. Parrour et al., in the ρ-ω interference in $\pi^+\pi^-$ decay mode paper. (auth)

28637 PRODUCTION OF MULTIBODY EVENTS BY e^+ AND e^- COLLIDING BEAMS. Frascati-Roma-Maryland-Padova Collaboration. pp 471-480 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

The apparatus used at Adone to record Bhabha scattering at wide angle, annihilation into muon pairs, and production of hadronic states by positron and electron colliding beams is described. Results are given of a preliminary analysis of multibody events at 0.7 to 1.05 GeV/beam. Estimated cross sections are given for $e^+e^- \to \pi^+\pi^-\pi^+\pi^-\pi^0$ and $e^+e^- \to \pi^+\pi^-\pi^+\pi^-$ interactions. (LBS)

28638 MULTIPLE PRODUCTION FROM e^+e^- ANNIHILATION, AND A FIRST OBSERVATION OF $\gamma + \gamma$ INTERACTION ($e^+e^- \to e^+e^-$ + OTHERS). Bacci, C.; Baldini-Celio, R.; Capon, G.; (and others) (Univ. of Rome). pp 480-488 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

Multiple particle production from e^+e^- annihiliation was studied using the Frascati electron-positron storage ring at center of mass energies 2E between (2 × 700) and (2 × 1200) MeV. It is assumed that the events are mostly hadronic in nature. Upper and lower limits of the cross sections for the following interactions at average energy 2E = 2 × 1000 MeV are given: $e^+e^- \to$ 2 charged pions + neutrals; $e^+e^- \to$ at least four charged particles + any number of neutrals; and $e^+e^- \to$ any multiple process with at least 3 particles, two being charged. The detection of processes with the electron and positron surviving the collision is also reported as a first evidence of $\gamma-\gamma$ interactions. (LBS)

28639 PROOF OF HADRON PRODUCTION IN e^+e^- INTERACTIONS. Alles-Borelli, V.; Bernardini, M.; Bollini, D.; (and others) (CERN, Geneva). pp 489-497 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

A search was made for the $e^+e^- \to h^\pm h^\mp$ and $e^+e^- \to h^\pm h^\mp$ + anything interactions at Adone energies of 700 to 1200 MeV. It is shown that in e^+e^- interactions at center-of-mass energies above the ρ, ω, ϕ region, hadronic final states are abundantly produced. (LBS)

28640 EXPERIMENTAL POSSIBILITY TO DETECT HIGHER ORDER ELECTROMAGNETIC PROCESSES AT ADONE. Barbiellini, G. (CNEN, Frascati, Italy); Orito, S. pp 505-511 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

To detect the almost real $\gamma\gamma$ collisions, the proposal is made to install a tagging system utilizing the bending magnets of ADONE. A main purpose is the experimental check against the contaminations on the 1γ (annihilation) processes coming from the higher order electromagnetic reactions such as $e^+e^- \to e^+e^-e^+e^-$, $e^+e^-\mu^+\mu^-$ or $e^+e^-e^+e^-e^+e^-$. The system also allows an investigation of the hadronic 2γ processes such as $e^+e^- \to e^+e^-\pi^+\pi^-$ or the production of c = +1 resonances like $e^+e^- \to e^+e^-\eta'$. Furthermore it is possible by this scheme to get a clean identification of the radiative vector meson productions. (auth)

28641 DEEP INELASTIC ELECTRON SCATTERING. Friedman, J. I.; Kendall, H. W. (Massachusetts Inst. of Tech., Cambridge). Annu. Rev. Nucl. Sci.; 22: 203-254(1972).

A review is given of deep inelastic electron scattering from protons and neutrons. Experimental work is mainly considered, but the main idea of the theoretical effort is also discussed. The experimental equipment and techniques, scattering formalism, scaling variables, separation of transverse and longitudinal contributions to cross sections, the range and validity of scaling behavior for proton, deuteron, and neutron, theoretical models, comparison of muon and electron scattering, sum rules, and collateral experiments are covered. (JFP)

28642 COHERENT PHOTOPRODUCTION OF THE NEUTRAL π^0 MESON ON DEUTERIUM IN THE VICINITY OF THE FIRST RESONANCE. Bouquet, B.; Buon, J.; Grelaud, B.; Nguyen Ngoc, H.; Petroff, P.; Riskalla, R.; Tchapoutian, R. (Ecole Normale Superieure, Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 134(1972). (In French).

The differential cross section corresponding to the coherent photoproduction of the neutral π^0 meson on deuterium ($\gamma D \to \pi^0 D$) was measured near the first resonance N*(1236) for photon energies varying between 220 MeV and 500 MeV and a constant momentum transfer (280 MeV/c). (FR)

Weak

Refer also to abstract 28902.

28643 (CONF-720582–, pp 59-65) RARE DECAY MODES OF VECTOR MESONS. Cosme, G. (Univ., Paris, Orsay, France). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

We present a measurement of the radiative decay modes of ϕ^0 and ω^0 mesons with the Orsay storage ring. The totality of the events have been rescanned, and we have now the complete static of the experiment. (auth)

28644 (FRNC-R–16, pp 92-129) EXPERIMENTS PLANNED IN THE MUON BEAM FACILITY AT N.A.L. Booth, N. E. (Oxford Univ.). 1972.

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

Experiments which are planned in the muon beam for N.A.L. up until 1976 are presented. In 1973, it is planned to obtain single arm data and considerable data on the hadrons produced in μ-p, μ-n and μ-complex nucleus collisions. In 1974 the Northeastern hadron experiment will probably be carried out (with a possible 2nd run). The first thing to be done will be then, probably, to run with the liquid hydrogen target inside the cyclotron magnet to get more information on multiplicity and momentum distributions of hadrons. Probably in 1975 another hadron experiment will be performed during half of the year. If a polarized target can be produced by say mid-1975, a preliminary look at the spin effects in muon proton scattering will then be obtained. (France)

28645 (FRNC-R–16, pp 130-138) EXPERIMENTAL DIFFICULTIES POSED BY HIGH ENERGY NEUTRINO PHYSICS IN THE CERN SPS. Aubert, J. J. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

High energy neutrino physics will enable weak interactions to be studied in an energy and an energy transfer range hitherto inaccessible. The different solutions possible for the ν beam envisaged at the CERN SPS are examined: beam with a wide band of momentum, and neutrino beams having known or measurable momenta. The technical problems to be solved before carrying out such experiments (GeV energy range) are examined. (France)

28646 (FRNC-R-16, pp 139-144) WEAK INTERACTIONS AT NAL (NEUTRINOS EXCEPTED). Vannucci, F. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

The research on weak interactions is summarized and includes the intermediate boson, second-class weak currents, and $K_1^0 \to 2\mu$ decay. (JFP)

28647 INFLUENCE OF INTERMEDIATE W-BOSON ON ANGULAR AND ENERGY DISTRIBUTIONS OF MUONS IN $\nu_\mu + Z \to Z + \nu_\mu + \mu^+ + \mu^-$ REACTION. Shchepkin, M. G. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 17: No. 1, 113-118(Jan 1973). (In Russian).

μ^+- and μ^--meson double differential angular and energy spectra for the reaction of W^+-boson production below threshold are calculated. Comparison with the spectra for the local four-fermion interaction shows that the difference in spectra of about 10% is achieved for $m_W \sim 40$ GeV at neutrino energy about 200 GeV. (auth)

28648 EXPERIMENTAL LIMITS ON THE FORM FACTORS IN $K^0_{\mu 3}$ DECAY. Peach, K. J. (Univ. of Edinburgh); Evans, G. R.; Muir, J.; Hopkins, H. W. K.; Krenz, W. Phys. Lett.; 43B: No. 5, 441-444(5 Mar 1973).

An analysis of 1385 $K^0_{\mu 3}$ decays observed in a heavy liquid bubble chamber is presented, and limits are obtained on the form factors $\xi(0)$ and λ_+. Assuming λ_+ to be 0.025, $\xi(0)$ is found to be -0.90 ± 0.45. (auth)

28649 EXPERIMENTAL STUDY OF THE $K_{\mu 3}$ DALITZ PLOT DISTRIBUTION. Zinner, E. K. St. Louis; Washington Univ. (1972). 241p. University Microfilms Order No. 73-5070.

Thesis (Ph. D.).

The decay $K^+ \to \pi^0 \mu \nu$ provides an excellent opportunity for investigating the structure of the strangeness-changing hadron current J^1_λ. The matrix element of this current connecting the K and π meson can be expressed in terms of two form factors f_+ and f_-, which depend only on the 4-momentum transfer to the final state lepton pair. An analysis of the Dalitz plot distribution for this decay enables one to measure the two related parameters $\xi(0) = f_-(0)/f_+(0)$ and λ_+, which is defined by $f_+(q) = f_+(0)(1 + \lambda_+ q^2/m_\pi^2)$. An experiment using counters and spark chambers was performed at the Princeton-Pennsylvania Accelerator. Kaons in a secondary unseparated beam were stopped in a BeO target, and $K_{\mu 3}$ decays were observed by detecting the muon and the two gamma rays from π^0. A total of 175,000 pictures was taken. For the Dalitz plot analysis subsequent data reduction yielded a sample of 535 reconstructed events containing approximately 350 $K_{\mu 3}$ decays. $K_{\mu 3}$ decays with resulting gamma showers were generated and "counted" in a Monte Carlo simulation of the experiment. All known sources of background were also simulated and added appropriately. The decay parameters (ξ, λ_+) imposed on the artificial $K_{\mu 3}$ decays were adjusted to produce a maximum likelihood match to the experimental data. The best-fit values and their error contours can be expressed as $\xi = -0.55^{+1.25}_{-1.50}$ and $\lambda_+ = -0.028^{+0.048}_{-0.066}$. These results are compared with previous experiments, and systematic errors are discussed in connection with possible future improvements to the present experimental approach. (LBS) (Diss. Abstr. Int. B)

Strong (Baryon-induced)

Refer also to abstracts 28762, 28899, and 28916.

28650 (FRNC-R-16, pp 58-91) FIRST RESULTS OBTAINED WITH THE ISR STORAGE RING. Coignet, G. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

The results obtained with the CERN storage ring (ISR) are examined just over one year after the first collision experiment. The characteristics of the ISR are briefly reviewed. The results obtained are presented under three headings: measurement of differential cross sections in pp elastic scattering; particle production with studies of inclusive reactions; measurement of angular distributions using emulsions, hodoscopes, scintillators and proportional counters. The information obtained concerns very high energy proton-proton interactions: variations in b, values of sigma (tot), sigma (elastic) and sigma (inelastic), and the production spectra of neutral particles (γ) and charged particles. (France)

28651 INVESTIGATION OF ELASTIC pd-SCATTERING AT 5 GeV IN THE INTERFERENCE RANGE OF COULOMB AND NUCLEAR INTERACTIONS. Zlatanov, Z. M.; Khristov, L. G.; Devenski, P. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 17: No. 1, 93-97(Jan 1973). (In Russian).

The results on measuring differential cross section for elastic pd scattering at 5 GeV in the range of transferred momentum $0.0039 \leq |t| \leq 0.12$ $(GeV/c)^2$ are presented. The experiment was performed on JINR synchrophasatron by detecting recoil particles in nuclear emulsion. The slope parameters of the diffraction cone at $t = -0.06$ $(GeV/c)^2$ and the real part of elastic pd-scattering amplitude were determined. The following results have been obtained: $B = 30.4 \pm 1.4$ $(GeV/c)^{-2}$ and $\alpha_{pd} = -0.40 \pm 0.09$. The experimental results are being compared with predictions following from dispersion relations. (auth)

28652 FACTORIZATION OF TOTAL AND INCLUSIVE CROSS SECTIONS ON NUCLEAR TARGETS. Bruno, D. R. O.; Pignotti, A.; Ripa, P.; Zgrablich, G. (Univ., Buenos Aires). Phys. Lett.; 43B: No. 4, 304-306(19 Feb 1973).

The analysis of proton fragmentation spectra in proton + nucleus $\to$ particle + anything yields a factorized dependence on the mass of the nucleus, A, approximately of the form $A^{0.5}$. This is contrasted with a factorized $A^{0.8}$ dependence in σ^{tot}(p + nucleus) and $A^{0.26}$ dependence in nucleus + nucleus $\to$ particle + anything found by other authors. (auth)

28653 MEASUREMENT OF THE SPIN ROTATION PARAMETER R IN PROTON-PROTON ELASTIC SCATTERING AT 6 AND 16 GeV/c. Deregel, J.; Bystricky, J.; Cozzika, G.; Ducros, Y.; Gaidot, A.; Lehar, F.; De Lesquen, A.; Merlo, J. P.; Miyashita, S.; Movchet, J.; Van Rossum, L.; Amblard, B.; Fontaine, J. M.; Hansroul, M. (CEN, Saclay, France). Phys. Lett.; 43B: No. 4, 338-340(19 Feb 1973).

The spin rotation parameter R in elastic proton-proton scattering has been determined at incident momenta 6 and 16 GeV/c in the interval from $t = -0.18$ $(GeV/c)^2$ to -0.54 $(GeV/c)^2 \cdot R_{pp}$ at 16 GeV/c is close to the values obtained for R in π^-p elastic scattering at the same incident momentum. Equality of R_{pp} (s,t) and $R_{\bar{p}p}$ (s,t) is expected if Pomeron exchange dominates and if factorization holds. The t-dependence of R at 16 GeV/c is consistent with weak helicity flip. (auth)

28654 STUDY ON ASYMMETRICAL SCATTERING OF SECONDARY CHARGED MESONS IN THE CMS IN THE PROTON-NUCLEUS INTERACTION AT E = 24 GeV IN EMULSIONS. Bandyopadhyay, B. K.; Daftari, I. K.; Roy, T. (Jadavpur Univ., Calcutta). J. Phys., A (London); 6: No. 3, L19-L20(Mar 1973).

220 events with $n_s \geq 5$, where the majority of the particles are identifiable, are considered to study the asymmetry parameter of secondary charged pions in the CMS in proton-nucleus interactions at E = 24 GeV in emulsion. In this experiment the asymmetry coefficient is found to be 0.24. (auth)

28655 INCLUSIVE CHARGED PION SPECTRA IN $\bar{p}n$ ANNIHILATIONS AT REST. Papadopoulou, T. (Democritus Nuclear Research Center Democritos, Athens); Filippas, T. A.; Gray, L.; Simopoulou, E.; Tsilimigras, P.; Vayaki, A.; Dris, M.; Kalogeropoulos, T. E.; Roy, J. Phys. Lett.; 43B: No. 5, 401-402 (5 Mar 1973).

An interesting parameterization of the π^+ and π^- inclusive spectra in $\bar{p}$ + n annihilations at rest was recently derived using the Mueller theorem and assuming duality. The predictions of this parameterization are compared with the charged pion spectra from the exposure of a deuterium bubble chamber to a stopping antiproton beam. (JFP)

28656 FIRST EXPERIMENTAL RESULTS FROM THE INTERSECTING STORAGE RINGS. Winter, K. (CERN, Geneva). Acta Phys. Austr., Suppl.; No. 9, 795-836(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

A review is given of results on p + p interactions up to 62 GeV cms studied in the CERN Intersecting Storage Rings. It is noted that evidence for the asymptotic behavior of hadronic matter is found from observation of a constant rate of shrinkage of the diffraction peak in elastic scattering and in the scaling property of particle production. (JFP)

28657 COSMIC-RAY HADRON INTERACTION WITH NUCLEI AT ENERGIES OF 200 to 2000 GeV. Azimov, S. A.; Abdullaev, A. M.; Mullazhonov, E. Zh.; Myalkovskii, V. M.; Yuldashbaev, T. S.

(Physical-Technical Inst., Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 6, 40-55(1972). (In Russian).

Experimental data are given for the characteristics of hadron interaction (from cosmic rays) with light and heavy nuclei such as paraffin and iron. The partial coefficient of inelasticity for the formation of π^0-mesons, the multiplicity of shower particles, and the angular distribution of secondary particles generated in paraffin targets at energies above 200 GeV were measured. (KSW)

28658 EVIDENCE OF S* PRODUCTION IN $\bar{p}p$ ANNIHILATIONS AT (1.1 TO 1.2) GeV/c. Duboc, J. (Institut de Physique Nucleaire, Paris); Goldberg, M.; Makowski, B.; (and others). (CERN, Geneva). pp 75-79 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Maximum likelihood fits were made to the $K^0_1K^0_1$ effective mass spectra from the reactions $\bar{p}p \to K^0_1K^0_1\pi^+\pi^-$ and $pp \to K^0_1K^0_1\pi^+\pi^-\pi^0$, using three different parametrizations for the S*: a simple Breit-Wigner formula, a Jackson formula, and a scattering length matrix element. The results are presented, which show that the resonance interpretation for this threshold effect is the best. It is also shown that the values for the mass and width of the S* are smaller than those generally found in πN interactions. (LBS)

28659 OBSERVATION OF NARROW 3π PEAKS IN THE $\delta^\pm$ AND A_1 REGION IN $\bar{p}p$ ANNIHILATIONS AT 5.7 GeV/c. Atherton, H. W.; Franek, B. J.; French, B. R.; (and others) (CERN, Geneva). pp 81-87 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna; Italy (14 Apr 1971). See CONF-710421-.

An analysis was made of the three charged pion system observed in the annihilation reactions $\bar{p}p \to \bar{K}Km\pi$ ($m \geq 1$) from a bubble chamber exposure at 5.7 GeV/c. Two peaks were observed which are identified as the $\delta(960)$ and the $A_1(1070)$. (LBS)

28660 EVIDENCE FOR THE δ MESON IN DECAYS OF THE D AND E MESONS. Defoix, C. (Coll. de France, Paris); Do Nascimento, A.; O'Neall, J. S.; (and others). pp 89-97 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Recent results are presented from a study of η^0 production in the reaction $\bar{p}p \to 3\pi^+3\pi^-\pi^0$ at 700 MeV/c. Evidence is seen for the final states $D^0\pi^+\pi^-$, $D^0\rho^0$, and $E^0\pi^+\pi^-$, followed by the decays $D^0, E^0 \to \delta^\pm\pi^\mp$, $\delta^\pm \to \eta^0\pi^\pm$, $\eta^0 \to \pi^+\pi^-\pi^0$. (LBS)

28661 MESON SPECTROSCOPY IN THE (2 TO 3) GeV MASS REGION. Fields, T. (Univ. of Birmingham, Eng.). pp 327-351 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Typical experimental results that have been obtained in searches for mesonic states above 2 GeV are summarized, paying most attention to results whose quoted precision is reasonably definitive, while trying to determine which kinds of experiments offer the most promise of yielding definitive new results. $\bar{N}N$ total cross sections, missing mass experiments, two-body annihilation, the V(2375), other $\bar{N}N$ S-channel structure, ρ-ω interference, and production experiments are topics discussed. (LBS)

28662 STUDY OF THE $\bar{p}n$ PARTIAL CROSS SECTIONS BETWEEN 1.0 AND 1.6 GeV/c. Bettini, A. (Univ., Padua); Cresti, M.; Mazzucato, M.; (and others). pp 353-360 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bolcgna, Italy (14 Apr 1971). See CONF-710421-.

Cross-section results of a $\bar{p}n$ formation experiment in the region of the first enhancement of the total cross section ($E^* \simeq 2190$ MeV) are discussed. (LBS)

28663 EVIDENCE FOR NARROW NONSTRANGE NEUTRAL BOSONS OF MASSES 2.370 AND 2.610 MeV PRODUCED IN $\bar{p}p$ ANNIHILATIONS AT 5.7 GeV/c. Atherton, H. W.; Celnikier, L. M.; Clayton, M.; (and others) (CERN, Geneva). pp 361-367 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Evidence is presented for two neutrally charged resonant states of mass (2374 ± 4) MeV and (2613 ± 7) MeV with narrow widths from a study of 12,000 $\bar{p}p$ annihilations into kaons and pions at 5.7 GeV/c in the CERN 2m hydrogen bubble chamber. Various channels were studied individually in order to investigate all possible decay modes or production mechanisms of these two states. (LBS)

28664 UPPER LIMIT TO THE $\bar{p}p$ COUPLING OF THE S(1929) MESON. Bizzarri, R. (Univ., Rome); Guidoni, P.; Marzano, F.; (and others). pp 369-375 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

It is shown that published data on $\bar{p}p$ cross sections together with new data on $\bar{p}n$ annihilation cross section in the momentum range 350 to 580 MeV/c allow a significant upper limit to be placed on the possible contribution of a resonant interaction to the backward $\bar{p}p$ elastic cross section if the resonance has a mass between 1915 and 1945 MeV and a width between 10 and 40 MeV. (LBS)

28665 SEARCH FOR HEAVY NEUTRAL MESONS IN $\bar{p}p$ ANNIHILATIONS. Cohen, K. (Rutgers-The State Univ., New Brunswick, NJ); Maglic, B.; Norem, J.; (and others). pp 377-380 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An attempt is made to measure the energy dependence of the $\bar{p}p$ annihilations to look at direct channel formation of heavy meson ($2.1 < M < 2.8$ GeV). A new experiment is attempted which combines some of the selectivity of a bubble chamber with the statistics of a total cross-section type experiment. No data is presented. (LBS)

28666 ANTINUCLEON-NUCLEON TWO BODY REACTIONS AT 1.2 GeV/c. Neuchatel-Lausanne Collaboration. pp 381-389 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An analysis was made of two pronged events and zero pronged events with associated odd pronged stars produced by antiprotons of 1.2 GeV/c in hydrogen bubble chambers. In order to select the two body events, a test of coplanarity was applied to the two pronged stars in the scanning procedure. (auth)

28667 SEARCH FOR A DIRECT CHANNEL EFFECT IN THE REACTION $\bar{p}p \to \rho^0\rho^0\pi^0$ IN THE C.M. ENERGY-RANGE (210 TO 2.22) GeV. Briand, H. (Institut de Physique Nucleaire, Paris); Duboc, J.; Durusoy, B.; (and others). pp 391-397 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An analysis was made of 55,000 5π events of $\bar{p}p$ annihilations at 1.1 to 1.47 GeV/c in order to find confirmation for a possible direct channel effect at the T position in the reaction $\bar{p}p \to \rho^0\rho^0\pi^0$. A maximum likelihood fit was performed, using besides phase space the matrix elements $\rho^03\pi$, $\rho^\pm3\pi$, $f^03\pi$, $\omega2\pi$, $\rho^0\rho^0\pi^0$, $\rho^0\rho^\pm\pi^\mp$, ωf^0, $\omega\rho^0$. A χ^2 fit for the channel $\bar{p}p \to \rho^0\rho^0\pi^0$, if interpreted in terms of a Breit-Wiger function, gives for the position of the observed bump $M = (2190 \pm 36)$ MeV/c^2 and $\sigma = (0.63 \pm 0.25)$ mb. (LBS)

28668 MASS STRUCTURE IN THE D^0 REGION. Duboc, J. (Institut de Physique Nucleaire, Paris); Goldberg, M.; Makowski, B.; (and others). pp 451-456 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The $K^0_1K^\pm\pi^\mp$ effective mass spectra in the D^0 region are analyzed from $\bar{p}p$ annihilations at 1.1 and 1.15 GeV/c. The D^0 was observed

in all reactions studied. Maximum likelihood fits for the one and two Breit-Wigner hypotheses are summarized. (LBS)

28669 POSSIBLE COMPLICATION IN THE A_2 MESON SITUATION. Clayton, J. (Univ. of Liverpool); Mason, P.; Muirhead, H.; (and others). pp 463-468 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An enhancement was observed in the $\pi^+\pi^-\pi^0$ mass spectrum in the A_2 region in the process $\bar{p}p \rightarrow 2\pi^+2\pi^-\pi^0$ at 2.5 GeV/c. Enhancements were observed in the mass spectra for both $\rho^\pm\pi^\mp$ and $\rho^0\pi^0$ channels. An analysis of the mass spectra for the I = 0, $J^P = 0^-$, 1^+, and 1^- shows the peak expected for the ω meson in the 1^- plot, together with an enhancement in the A_2 region. Calculations were carried out for I = 0 and 1 states and $J^P = 0^-$, $1^\pm$, $2^\pm$, $3^\pm$, which show that the most likely quantum numbers for the A are I = 0, $J^P = 1^-$, 3^- or I = 1, $J^P = 3^-$. (LBS)

Strong (Meson-induced)

Refer also to abstracts 28779 and 28804.

28670 (COO-1428-312) PROPOSAL TO MEASURE THE DIFFERENTIAL CROSS SECTIONS FOR SEVERAL Δ^{++} EXCHANGE REACTIONS. Dixon, R. L.; Garfinkel, A. F.; Loeffler, F. J.; Mudrak, S.; Palfrey, T. R. Jr.; Shibata, E. I.; Stanfield, K. C.; Hoffman, E. W. (Purdue Univ., Lafayette, Ind; Argonne National Lab., Ill.). Sep 1972. Contract AT(11-1)-1428. 42p. Dep. NTIS $4.25.

The experimental study of two body reactions in which only a few trajectories are exchanged continues to be a prime source of our understanding of high energy dynamics. Even so, little other than elastic and charge exchange data have been taken systematically for backward (u-channel exchange) reactions. We propose here to further study u-channel reactions in the incident momentum range from 3 to 6 GeV/c and for u values $.1 < |u-u_0| < (\sim 1.0)$ $(GeV/c)^2$, where $u_0 = u(180°)$. We will build a spectrometer utilizing spark chambers and counters to detect and momentum analyze the backward going meson. With this information the mass of the forward going baryon may be calculated. In some cases the proton from the decay of this baryon will be detected in spark chambers near the forward direction; hence, polarization for a reaction such as $K^-p \rightarrow \Sigma^+\pi^-$ will be measured. (auth)

28671 (FRNC-R-16, pp 1-31) IDENTIFICATION OF PARTICLES AT VERY HIGH ENERGIES. Kuroda, K. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

The technical difficulties encountered in attempting to identify very high energy particles (200 to 300 GeV/c) are presented together with the recent technical developments made in this field. Only the case of discriminating charged particles by virtue of their mass is considered. The performance already obtained using Cherenkov counters (threshold counters, differential counters, and single channel counters) and the improvements envisaged suggest that a resolution ($\Delta\beta/\beta$) of between 10^{-6} and 10^{-7} would enable these counters to be used to discriminate particles with momenta of less than 500 GeV/c. Different techniques are currently being developed (enhancement in the relativistic energy losses, transition radiation). The transition radiation technique appears to be the most promising, as in principle, there are no saturation phenomena limiting its field of application. (France)

28672 (FRNC-TH-323) STUDY OF NONSTRANGE BOSON RESONANCES PRODUCED IN 11.7 GeV/c π^+ INTERACTIONS ON DEUTERIUM. Huc, J. (Paris Univ. (France)). 1972. 193p. (In French). Dep. NTIS (U. S. Sales Only) $11.75.

Thesis.

Investigations of π^+d interactions at 11.7 GeV/c were undertaken in view of studying the production mechanisms of the resonances occurring in the $\pi^+d \rightarrow pp\pi^+\pi^-$ and $\pi^+d \rightarrow pp\pi^+\pi^-\pi^0$ channels. The cross section of the $p\pi^+\pi^-$ channel is (615 ± 30) μb. The $\pi^+\pi^-$ system exhibits enhancements in the ρ, f, g, and U regions. The ρ^0 region is compatible with the general observation of an asymmetry, which increases with the energy. The possibility of a splitting in the f^0 region (particularly at small transfers) is discussed. Angular analysis implies the existence of a least one S wave. The g^0 region exhibited a relatively important enhancement that might be resolvable into several peaks. An enhancement is observed in the U(2380) mass region. The $pp\pi^+\pi^-\pi^0$ cross section is (830 ± 35) μb. A systematic investigation of the resonances produced by nonexotic exchange was conducted: π exchange: formation of ρ^0, f^0, g^0 (ρ^+, g^+) and $N^{*+}(N^{*0})$ resonances and the associated production of ρN^*, fN^*, and gN^*; ρ exchange: enhancements were observed in the ω^0; A_2^0, a and A_3^0 regions and in the 2000 MeV region. Other channels do not present structures which can be interpreted. (France)

28673 (ORO-2504-194) DIFFERENTIAL CROSS SECTION OF K⁻P ELASTIC SCATTERING BETWEEN 1.4 AND 1.9 GeV/c. Technical Report No. 73-056. Abe, K. (Maryland Univ., College Park. Dept. of Physics and Astronomy). 1973. 92p. Dep. NTIS $6.75.

Thesis.

Wire spark chambers were used to measure the differential cross section for $K^- + p \rightarrow K^- + p$ interactions at 1.4 to 1.9 GeV/c. The dip structures are discussed. (JFP)

28674 (ORO-2504-203) MEASUREMENT OF THE POLARIZATION PARAMETER IN K^+p ELASTIC SCATTERING. Technical Report No. 73-096. Barnett, B. A.; Laasanen, A. T.; Koehler, P. F. M. (Maryland Univ., College Park. Dept. of Physics and Astronomy). Mar 1973. 52p. Dep. NTIS $4.75.

Full angular distributions of the polarization parameter in elastic K^+p scattering at 1.37, 1.45, 1.60, 1.71, 1.80, 1.89, 2.11, and 2.31 GeV/c are presented. These data were obtained in an experiment at the ZGS using a polarized proton target with arrays of scintillation and Cherenkov counters to detect the scattered particles. The data were used in phase-shift analysis to search for S = +1 baryon resonances in this energy region. (auth)

28675 MEASURING DIFFERENTIAL CROSS SECTIONS OF INVERSE PION ELECTROPRODUCTION ($\pi^-p \rightarrow e^+e^-n$) CLOSE TO $\Delta(1236)$ RESONANCE. Berezhnev, S. F.; Dem'yanov, A. V.; Kulikov, A. V.; Kuptsov, A. V.; Kurochkin, V. P.; Mkrtchyan, G. G.; Nemenov, L. L.; Pustyl'nik, Zh. P.; Smirnov, G. I.; Fedunov, A. G.; Khazins, D. M. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 17: No. 1, 85-92(Jan 1973). (In Russian).

The reaction of inverse pion electroproduction $\pi^-p \rightarrow e^+e^-n$ was studied at 276 MeV pion kinetic energy. The main characteristics of apparatus, as well as measuring and processing procedures, are being described. As a result 226 ± 31 events have been selected. Differential cross section of the reaction for electrons with energies E_1 and $E_2 > 60$ MeV emitted at angles close to 90° with respect to the pion beam is $d^2\sigma/d\Omega_1 d\Omega_2 = (4.0 \pm 0.6) \cdot 10^{-33}$ $cm^2/sterrad^2$. Event distributions versus four-different kinematic variables are presented. (auth)

28676 K^- MASS AND K^- POLARIZABILITY FROM KAONIC ATOMS. Backenstoss, G.; Bamberger, A.; Bergstroem, I.; Bunaciu, T.; Egger, J.; Hagelberg, R.; Hultberg, S.; Koch, H.; Lynen, Y.; Ritter, H. G.; Schwitter, A.; Tauscher, L. (CERN, Geneva). Phys. Lett.; 43B: No. 5, 431-436(5 Mar 1973).

The K^- mass was determined from kaonic atomic x-rays from Au and Ba to be 493.691 ± 0.040 MeV. An upper limit for the polarizability of the K^- was found to be 0.020 fm^3 at 90% confidence. (auth)

28677 MEASUREMENTS OF THE A_2^- AND A_2^+ MASS SPECTRA. Tang, Y. W. Boston; Northeastern Univ. (1972). 286p. University Microfilms Order No. 73-4652.

Thesis (Ph. D.).

Observations of the mass distribution of the A_2 meson produced in the reaction $\pi p \rightarrow A_2 p$ are reported. The experimental methods and data analysis techniques used in the measurements are discussed in detail. The A_2's were observed using a missing mass technique. Measurements were made with 5 and 7 GeV π^- as well as 5 GeV π^+ beams. For each beam setting (5^-, 5^+ and 7^- GeV), more than 17,000 A_2's above background were observed with $0.20 \leq |t| \leq 0.29$ $(GeV)^2$. The A_2 peaks are well described by a Breit-Wigner shape, whereas the dipole mass formula does not fit the data. The dipole hypothesis is rejected by approximately 27, 20, and 14 standard deviations by the 5^-, 5^+, and 7^- GeV data, respectively. The A_2 differential production cross sections were measured and are in agreement with results published by others. (Diss. Abstr. Int., B)

28678 TRIPLE REGGE ANALYSIS OF THE REACTIONS $K^-p \rightarrow A + X$ AND $K^-p \rightarrow \bar{K}^0 + X$ AT 14.3 GeV/c. Paler, K. (Rutherford High Energy Lab., Chilton, Eng.); Shah, T. P.; Miller, R. J.; Phelan, J. J.; Chaurand, B.; Drevillon, B.; Labrosse, G.; Lestienne, R.; Linglin, D.; Salmerson, R. A.; Barloutaud, R.; Borg, A.; Louedec, C.; Pierre, F.; Spiro, M. Phys. Lett.; 43B: No. 5, 437-440(5 Mar 1973).

New data from the reactions $K^-p \rightarrow A + X$ and $K^-p \rightarrow \bar{K}^0 + X$ at 14 GeV/c are presented. From an analysis of the distributions of M_X^2 within the framework of a triple Regge formalism we obtain the effective Regge trajectories corresponding to ρ, K or K* and nucleon exchange. (auth)

28679 ELASTIC π^-p-SCATTERING AT p_{π^-} = 4.45 GeV/c. Kartamyshev, A. A.; Mukhin, K. N.; Romantseva, A. S.; Sulkovskaya, M. M.; Sustavov, A. F. (Inst. of Atomic Energy, Moscow). Yadern, Fiz.; 17: No. 1, 81-84(Jan 1973). (In Russian).

Differential cross section for elastic π^-p scattering at p_{π^-} = 4.45 GeV/c was measured with a hydrogen bubble chamber method. In the diffraction region $d\sigma/dt$ is approximated by the exponential exp (At) with the coefficient A = (7.6 ± 0.3) $(GeV/c)^{-2}$ and simple optical model with the parameters R = (1.09 ± 0.02) · 10^{-13} cm, 1 − a = 0.40 ± 0.02. Total cross section for elastic scattering is equal to σ_{el}^{tot} = 6.18 ± 0.38 mbarn. The summary of the results on all the studied ($\pi^-p \to \pi^-\pi^+n$, $\pi^-p \to \pi^-\pi^0p$ and $(\pi^-p \to \pi^-p)_{el}$) processes, corrected for new normalizing value σ_{el}^{tot}, is presented. (auth)

28680 DEUTERON SCREENING AT HIGH ENERGIES: AN APPLICATION OF TRIPLE-REGGE ANALYSIS. Quigg, C. (State Univ. of New York, Stony Brook); Wang, L. L. Phys. Lett.; 43B: No. 4, 314-318(19 Feb 1973).

We use a Regge pole analysis of the CERN-IHEP Boson Spectrometer measurements of the reaction $\pi^-p \to p$ + anything at 25 and 40 GeV/c to estimate Glauber corrections to πd scattering. Inelastic rescattering becomes appreciable above 20 GeV/c, and accounts for recent experimental observations. Deuteron scattering can serve as an internal-consistency check for the Reggeon calculus; to this end, additional experiments are suggested. (auth)

28681 ANALYSIS OF THE DECAY MODES OF THE ρ' (1600) MESON. Ceradini, F. (Univ., Rome); Conversi, M.; D'Angelo, S.; Paoluzi, L.; Santonico, R.; Ekstrand, K.; Grilli, M.; Iarocci, E.; Spillantini, P.; Valente, V.; Visentin, R.; Nigro, M. Phys. Lett.; 43B: No. 4, 341-344(19 Feb 1973).

An analysis of $\pi^+\pi^-\pi^+\pi^-$ events from e^+e^- annihilation yields preliminary evidence for the decay scheme $\rho'(1600) \to \rho^0(760) + \epsilon^0(800)$. Assuming this decay scheme the coupling constant of the ρ' meson to the photon is evaluated. (auth)

28682 STRANGE-PARTICLE PRODUCTION IN π^-D INTERACTIONS AT 5 GeV/c. Durusoy, N. B. (Univ., Paris); Goldberg, M.; de Rosny, G.; Kayas, G. Lett. Nuovo Cim.; 6: No. 10, 381-387(10 Mar 1973).

The production of strange particles in the interactions of 5 GeV/c-π^- mesons on deuterium were studied by means of 200,000 pictures taken in the 81 cm deuterium bubble chamber at the CERN proton synchrotron. Cross sections are given for the different reactions selected. Differential cross-section distributions and mass spectra are given for the reactions $\pi^-n \to K^0\Sigma^-$, $\pi^-n \to K^0\pi^-\Lambda^0$, and $\pi^-n \to K^+\pi^-\pi^-\Lambda^0$. Density matrix elements of Y* and K* are also given. (LBS)

28683 SELECTED REVIEW OF SINGLE-PARTICLE AND TWO-PARTICLE INCLUSIVE REACTION EXPERIMENTS. Kenney, V. P. (Univ. of Notre Dame, IN). Acta Phys. Austr., Suppl.; No. 9, 463-478(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224−.

Attention is given to the data of the inclusive reactions $\pi^-p \to \pi^-$ + anything, $\pi^+p \to \pi^-$ + anything and $\pi^+p \to \pi_c^- + \pi_d^-$ + anything. (auth)

28684 BACKWARD πN CHARGE EXCHANGE AT 4.3 GeV/c AND 6.0 GeV/c. Chen, G. T. Y. Providence; Brown Univ. (1972). 127p. University Microfilms Order No. 73-2245.

Thesis (Ph.D.).

The preliminary analysis of the reaction $\pi^-p \to n\pi^0$ in the backward hemisphere at incident pion momenta of 4.3 and 6.0 GeV/c is described. The angular distribution over the u interval $u_{max} > u > -.9$ GeV^2 at 6.0 GeV/c, and $u_{max} > u > -.6$ GeV^2 at 4.3 GeV/c was measured. Counters and optical spark chambers were used to detect the reaction and decay particles. The two energies covered in this thesis are part of a comprehensive sweep of the intermediate energy region in the study of backward charge exchange. The methods of analysis used are discussed. (Diss. Abstr. Int., B)

28685 CONDITIONS FOR OBSERVING A SPLIT A2-MESON IN A BUBBLE CHAMBER STUDY OF 6.5 GeV/c π^+p INTERACTIONS. Stupic, J. Bloomington, IN; Indiana Univ. (1972). 111p. University Microfilms Order No. 73-2758.

Thesis (Ph.D.).

A study is made of the factors affecting the experimental resolution in bubble chamber measurements of 6.5 GeV/c π^+ mesons interacting with protons. The experiment considered was performed using the 30 inch hydrogen bubble chamber at the ZGS facility at the Argonne National Laboratory. The momentum of the π^+ beam was 6.5 GeV/c. In all, some 317,500 frames of pictures were taken, with an average of 9 beam particles per frame. This corresponds to the yield of above 4 events per microbarn for the acceptable fiducial volume. The conclusions about the errors are based mainly on the results of calculations on simulated final states. Complementary to the simulation study was the use of a small sample of experimental data. It was found that the setting error for the combination of the measuring machines and the 30 inch bubble chamber should be about 100 microns. The results of the study indicate that with the measuring procedure currently used on PEPR errors of 13 MeV can be achieved on the three-pion effective mass in the A2 mass region, as calculated from the geometrically reconstructed, unfitted parameters. After the four-constraint fitting, as indicated by a simulation study using the program SQUAW, the average error on three-pion effective mass in the A2 mass region will be between 5 and 6 MeV if the beam momentum is known to ±.5%. Studies of the beam indicate that its momentum is known to this accuracy. In this experiment, about 200 events are expected in the A2 meson peak above the background, when the well established cuts are imposed, the signal of course coming mainly from the $\rho^0\pi^+$ decay mode of the $A2^+$. If this decay mode of $A2^+$ exhibits structure similar to that found in the CERN $A2^-$ experiments, a two to three standard deviation effect will be observed in this experiment. (Diss. Abstr. Int., B)

28686 MEASUREMENT OF π^- + PROTON → NEUTRON + γ DIFFERENTIAL CROSS SECTIONS NEAR THE $P_{33}(1232)$ RESONANCE TO TEST THE $\Delta I \leq 1$ RULE AND TIME REVERSAL INVARIANCE. Comiso, J. C. Los Angeles; Univ. of California (1972). 163p. University Microfilms Order No. 73-1689.

Thesis (Ph.D.).

A measurement of $\pi^- + p \to n + \gamma$ differential cross section was made for pion energies of 135 MeV, 157 MeV, and 258 MeV, in the angular interval between 50° and 150°. The experiment was performed at the Lawrence Berkeley Laboratory using the 184″ synchrocyclotron. If interpreted in the framework of the Sanda and Shaw model, the results are consistent with no isotensor component of the electromagnetic current. When compared with the inverse reaction deduced from γd experiments, no violation of time reversal invariance is observed in the 135 MeV and the 157 MeV measurements, but a small discrepancy is seen in the 258 MeV data. (Diss. Abstr. Int., B)

28687 MEASUREMENT OF DIFFERENTIAL CROSS SECTIONS FOR π^- + PROTON → γ + NEUTRON AT EIGHT PION MOMENTA BETWEEN 500 AND 900 MeV/c. Weiss, A. J. Los Angeles; Univ. of California (1972). 157p. University Microfilms Order No. 73-1739.

Thesis (Ph.D.).

A measurement made at the Lawrence Berkeley Laboratory Bevatron of the differential cross section for $\pi^-p \to \gamma n$ is discussed, consisting of an excitation curve at θ_γ(CM) = 90° for eight pion momenta between 500 and 900 MeV/c, and four angular distributions between 500 and 700 MeV/c. The momentum range corresponds to the region 1370 to 1610 MeV total center-of-mass energy. This region includes the $P_{11}(1470)$, $D_{13}(1520)$, and $S_{11}(1535)$ resonances. The couplings of these resonances to radiative channels are not well established. The results are compared to recent measurements of the inverse reaction, $\gamma n \to \pi^-p$, using detailed balance. The agreement is good, and the results indicate appreciable P_{11} and S_{11} couplings. The results also suggest that the S_{11} is excited by isoscalar photons, while the other resonances in this region are excited by isovector photons. (Diss. Abstr. Int., B)

28688 COMPARISON OF THE SPIN DENSITY MATRIX ELEMENTS OF K*(892) AND N*(1236) RESONANCES PRODUCED IN 5 GeV/c K^+p INTERACTIONS WITH PREDICTIONS OF THE ABSORPTION MODEL. Huq, S. S.; Jobes, M. (Univ. of Birmingham, Eng.). Pak. J. Sci. Ind. Res.; 15: No. 1-2, 6-8(1972).

The reaction $K^+p \to K^+p\pi^+\pi^-$ at 5 GeV/c proceeds predominantly via the production of K*(892) and N*(1236) resonances. The spin density matrix elements ρ_{00}, ρ_{1-1} and Re ρ_{10} of the K*(892) resonance and ρ_{33}, Re ρ_{3-1} and Re ρ_{31} of the N*(1236) resonance were determined in five regions of four momentum transfer from the target proton to the outgoing $p\pi^+$ system ($\Delta^2p \to p\pi^+$) by fitting the resonance decay angular distributions using a maximum likelihood method. The variation of the density matrix elements with Δ^2 agree reasonably well with the predictions of the absorption model. (auth)

28689 MESON RESONANCES AND RELATED ELECTROMAGNETIC PHENOMENA. Proceedings of the 1st International Conference, Bologna, 14−16 April 1971. Dalitz, R. H.; Zichichi, A. (eds.). Bologna; Editrice Compositori (1972). 635p. (CONF-710421−).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971).

Fifty-six papers are included; separate abstracts are prepared for fifty-one. Five papers were previously abstracted for NSA; see CONF-710421 in a cumulative Report Number Index. (LBS)

For abstracts of individual papers see: 27720, 27721, 28635–28640, 28658–28669, 28690–28705, 28746–28752, 28793, and 28778–28784.

28690 DIPION SYSTEM UP TO THE G-MESON REGION IN THE REACTION $\pi^-p \rightarrow \pi^+\pi^-n$ AT 17.2 GeV/c WITH A BIG MAGNET SPECTROMETER. Grayer, G. (CERN, Geneva); Hyams, B.; Jones, C.; (and others). pp 25-33 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

The magnet spectrometer of the CERN-Munich Collaboration using magnetostrictive wire chambers on line to a PDP-9 computer is briefly described. Preliminary results on the mass spectra and angular distribution of the $\pi^+\pi^-$ system in the mass range from 0.280 to 2.0 GeV/c^2 of the reaction $\pi^-p \rightarrow \pi^+\pi^-n$ at 17.2 Gev/c are presented. (LBS)

28691 $\pi\pi$ SCATTERING FROM CHEW–LOW EXTRAPOLATION OF $\pi^-p \rightarrow \pi\pi N$ AT 2.77 GeV/c. Baton, J. P.; Laurens, G.; Reignier, J. (CEN, Saclay, France). pp 35-51 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

The elastic cross section for $\pi^+\pi^-$ scattering is determined up to 1.2 GeV by applying the Chew–Low extrapolation method on a high-statistics bubble-chamber experiment on the $\pi^-p \rightarrow \pi^-\pi^+n$ interaction at 2.77 GeV/c. Different types of extrapolation procedures are used and their results are compared. The results of a phase shift analysis of $\pi^-\pi^0$ and $\pi^+\pi^-$ elastic scattering data obtained through Chew–Low extrapolation of the reactions $\pi^-p \rightarrow \pi^+\pi^-n$ and $\pi^-p \rightarrow \pi^-\pi^0p$ at 2.77 GeV/c are presented. (auth)

28692 INFORMATION ON THE S- AND P-WAVE I = ½ Kπ PHASE SHIFTS. SABRE Collaboration. pp 53-56 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

Data from an experimental investigation of the reaction $K^- + d \rightarrow p_s + p + K^- + \pi^-$ at 3 GeV/c are used to study the angular distributions of the outcoming K^- meson in the $K^-\pi^-$ rest frame, which together with the $\sigma_{K^-\pi^-}$ values are used to obtain information on the relevant phase shifts which contribute to the $K^-\pi^-$ scattering in this energy region. (LBS)

28693 ω–ρ INTERFERENCE IN $\pi^+\pi^-$ DECAY MODE. Benaksas, D; Cosme, G.; Jean-Marie, B.; (and others) (Ecole Normale Superieure, Orsay, France). pp 125-131 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See Conf-710421–.

A large solid angle detector has been used to observe two body events produced by electron-positron collision in the Orsay storage ring. From the $\pi^+\pi^-$ excitation curve in the ρ region the ω–ρ interference parameters were deduced: $A = (2.41 \pm 0.68)\%$ corresponding to $\Gamma^{\frac{1}{2}}_{\omega\pi\pi} = (0.63 \pm 0.18)$ MeV$^{\frac{1}{2}}$, $\alpha = (89.1 \pm 15)^0$. (auth)

28694 ω–ρ INTERFERENCE IN π–p INTERACTIONS AT 1.67 GeV/c. Basile, M.; Bollini, D.; Bowen, R. A.; (and others) (CERN, Geneva). pp 139-145 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

A study of the reaction $\pi^- + p \rightarrow n + \pi^+ + \pi^-$ at 1.67 GeV/c using a neutron missing-mass spectrometer coupled to a system of optical spark chambers is reported. The parametrization of the $\rho - \omega$ interference was done using two Breit–Wigner resonances for the ρ and for the ω. The branching ratio for $\omega \rightarrow \pi^+\pi^-$ was also obtained. (LBS)

28695 ANALYSIS OF THE REACTION $K^+p \rightarrow Q^+p$ FROM 2.5 to 12.7 GeV/c. Bingham, H. H. (CERN, Geneva); Eisenstein, L.; Goldschmidt-Clermont, Y.; (and others). pp 173-188 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

An analysis is made of the reaction $K^+ + p \rightarrow Q^+ + p \rightarrow K^+ + \pi^+ + \pi^- + p$ interaction, using a sample of approximately 77,000 four-constraint events from fourteen different bubble chamber experiments with K^+ momenta from 2.5 to 12.7 GeV/c. Results are given on mass distributions and cross sections, spin-parity determinations, and the density matrix of the Q. (LBS)

28696 COMPARISON OF A_1–A_2 INTERFERENCE BETWEEN π^-p AND π^+p REACTIONS AT GeV/c. Bonn-Durham-Nijmegen-Paris E.P.–Torino Collaboration. pp 189-195 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

A comparison is made of the interference terms between A_1 and A_2 of the π^-p reactions with those of the π^+p reactions, using data from the reactions $\pi^\pm p \rightarrow \pi^\pm\pi^+\pi^-p$ at 5 GeV/c. To isolate the interference term between a 1^+ and a 2^+ state decaying to 3π, the moments of the distributions of the three Euler angles that describe completely the 3π decay plane were analyzed. The most significant moments are shown as a function of the $\pi\rho$ mass for events in the inner half of the Dalitz plot. The interference effect is found to be similar in π^- and π^+ data, and all the moments are found to have the same sign at the A_2 position in π^- and π^+ reactions. The interpretation given for the interference effect is that part of the A_2 production is due to f^0 exchange and that only this part is coherent with the A_1 production amplitude. (LBS)

28697 OBSERVATION OF THE B MESON IN THE REACTION $p\pi^+ \rightarrow p\omega\pi^+$ AT 11.7 GeV/c. Durham-Genova-Hamburg-Milano Saclay Collaboration. pp 197-209 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

Some characteristics of the B^+ meson observed in the $\omega\pi^+$ mass spectrum from 6903 selected events of the $\pi^+p \rightarrow p\pi^+\pi^-\pi^0$ interaction are discussed. Cross sections and $\omega\pi$ effective mass distributions are presented. (LBS)

28698 DECAY MODE $X^0 \rightarrow \gamma\gamma$ AND FIRST DETERMINATION OF THE BRANCHING RATIO $X^0 \rightarrow \gamma\gamma/X^0 \rightarrow$ TOTAL. Basile, M.; Bollini, D.; Dalpiaz, P.; (and others) (CERN, Geneva). pp 255-264 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

The results of an experiment designed to establish on the basis of high statistics the existence of the decay mode $X^0 \rightarrow \gamma\gamma$ and to measure the branching ratio $X^0 \rightarrow \gamma\gamma/X^0 \rightarrow$ total are reported. The missing-mass spectrum for approximately 1300 selected $\pi^-p \rightarrow n\gamma\gamma$ events at 1.61 GeV/c was measured. Cross sections and branching ratios are given along with a discussion of the results. (LBS)

28699 EVIDENCE FOR THE NEW DECAY MODE $\phi \rightarrow \eta\gamma$. Basile, M.; Dalpiaz, P.; Frabetti, P. L.; (and others) (CERN, Geneva). pp 265-271 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

Evidence is presented for the observation of the $\phi \rightarrow n\gamma$ decay mode from a study of the missing-mass spectra in the reaction $\pi^- + p \rightarrow n + MM$ at 1.8 GeV/c. A preliminary measurement is made of the branching ratio $\Gamma(\phi \rightarrow n\gamma)/\Gamma(\phi \rightarrow \text{total})$. (LBS)

28700 PROBLEMS OF THE L-MESON. Hughes, I. S. (Univ. of Glasgow). pp 293-308 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421–.

Some problems discussed concerning the L meson are the

following: conclusive establishment of decay modes and branching fractions; establishment of J^P; and data concerning production characteristics (σ and $d\sigma/dt$). (LBS)

28701 MESON SPLITTING. Massam, T. (Univ., Bologna). pp 401-426 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An introductory review is given on meson splitting, concentrating mainly on the classification of the experiments in order to show up any systematic effects which might give a clue to the answers of some of the questions on the splitting. Two main questions are: what is the A_2 splitting and what is the mechanism which produces it? The results are compared in the various classes: $\pi^-p \to A_2^- p$; $\pi^-p \to nA_2^0$; $\pi^+p \to pA_2^+$; $\bar{p}p \to A_2\pi$; and $K^-n \to A_2^-\Lambda^0$. The question of splitting of other members of the 2^+ nonet is also discussed. (LBS)

28702 MEASUREMENTS OF THE A_2^- AND A_2^+ MASS SPECTRA. Bowen, D. (Northeastern Univ., Boston); Earles, D.; Faissler, W.; (and others). pp 427-434 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The reaction $\pi^-p \to p(MM)^-$, $(MM)^- \to \pi^-(MM)^0$ was studied at 5 and 7 GeV in order to measure the mass spectra of A_2^+ and A_2^-. The mass resolution was measured by two methods, one giving an upper limit for the resolution, the other giving the precise value of the mass resolution. A mass resolution is obtained which is sufficient to detect two peaks 40 MeV apart. (LBS)

28703 A_2^- FROM THE REACTION $\pi^-p \to K_S^0K^-p$ AT 4.5 GeV/c. Lai, K.-W. (Brookhaven National Lab., Upton, NY). pp 435-443 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The results of a study of $A_2^- \to K_S^0K^-$ from a sample of 542 events from the reaction $\pi^-p \to K_S^0K^-p$ are reported. The $K_S^0K^-$ mass distributions are presented and discussed. It is observed that the $A_2^- \to K_S^0K^-$ for all t values does not show the split seen in the 7 GeV/c π^- CERN experiment. It is concluded that, within the limited statistics, the $A_2^- \to K_S^0K^-$ and $A_2^+ \to K_S^0K^+$ exhibit no obvious difference. It is further suggested that the structure (or nonstructure) $A_2^- \to K_S^0K^-$ has no energy dependence between 4.5 and ~20 GeV/c. (LBS)

28704 MASS SPECTRA OF A_2^- AND f^0. Grayer, G. (CERN, Geneva); Hyams, B.; Jones, C.; (and others). pp 445-449 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The reaction $\pi^-p \to pK^-K^0$, $K^0 \to \pi^+\pi^-$ with 17.2 GeV incident π^- was studied, using a magnet spectrometer with magnetostrictive spark chambers. The invariant mass spectrum of the $K-K^0$ system is shown. The reaction $\pi^-p \to n\pi^+\pi^-$ at 17.2 GeV was also measured, observing the outgoing $\pi^+\pi^-$ and identifying the neutron by a peak in the missing mass spectrum. The $\pi^+\pi^-$ mass spectra in the f^0 region are shown which fit well to a single broad spin-2 Breit-Wigner resonance. Preliminary results obtained from an experiment measuring $\pi^-p \to pK^-K^0$ at 9.8 GeV are also described. It is concluded that the A_2^- and f^0 are broad spin 2 resonances, with no sign of dipoles, splits, or structure required by the data. (LBS)

28705 EVIDENCE FOR STRUCTURE IN THE f^0 MASS REGION. Scarrott, S. M. (Univ. of Durham, Eng.); Major, J. V.; Kemp, D. (and others). pp 457-462 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From International Conference on Meson Resonances and Related Electromagnetic Phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

Evidence for a possible structure in the f^0 mass region is presented for the reaction $\pi^+d \to p_sp\pi^+\pi^-$ at 11.7 GeV/c. The f^0 mass distribution was fitted with a single Breit-Wigner curve, two incoherent Breit-Wigner curves, two coherent Breit-Wigner curves, and a symmetric dipole. It is concluded that although a single peak without structure is not excluded, it is much more probable that the f^0 mass peak is split into two parts centered approximately at 1220 and 1310 MeV, each with a full width ~50 MeV. (LBS)

Particle Interactions and Properties (Theoretical)

Refer also to abstract 28843.

General

Refer also to abstracts 28623 and 28818.

28706 PRODUCTION OF PARTICLES WITH LARGE TRANSVERSE MOMENTUM AT HIGH ENERGIES. D'yakonov, D. I. (Inst. of Nuclear Physics, Leningrad). Yadern. Fiz.; 17: No. 1, 140-149(Jan 1973). (In Russian).

Production processes of particles with large pairing energy and large transverse momenta are described by a large arbitrary number of reggeons between each pair of final particles. It is shown that scattering of final particles on each other is of quasi-classical character at large momentum transfer. This fact considerably simplifies calculations and investigation of the amplitudes of the processes in question. Theory predicts characteristic correlations between the emission angles of particles in the perpendicular plane, which can be observed. (auth)

28707 ORIGIN AND INTERCEPT OF THE POMERANCHUK SINGULARITY. Veneziano, G. (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Lett.; 43B: No. 5, 413-416(5 Mar 1973).

Assuming that the nondiffractive part of exclusive cross sections contributes to the Pomeranchuk singularity in the total cross section, we derive general relations between Regge intercepts and parameters of the multiplicity distribution. A dynamical assumption on the mechanism that generates the Pomeron gives automatically an intercept near one provided that a particular correlation parameter is small. (auth)

28708 SOLUTION OF THE KAELLEN-PAULI EQUATION FOR UNSTABLE AND STABLE PARTICLES. Luchnikov, L. A. Teor. Mat. Fiz.; 14: No. 3, 357-365(Mar 1973). (In Russian).

The solution of the Källén-Pauli equation for physical values of parameters is obtained. It is proved that homogeneous equation has only trivial solutions. The solution obtained may be useful for studying the resonant final states of interacting particles and for derivation of the angular distribution, energy dependence and polarization distribution of the stimulated radiation. (auth)

28709 HIGH ENERGY PHYSICS INDEX. Volume 11, No. 6, 1973. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 91p.

28710 HIGH ENERGY PHYSICS INDEX. Volume 11, No. 7, 1973. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 78p.

28711 HIGH ENERGY PHYSICS INDEX. Volume 11, No. 5, 1973. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 95p.

28712 PHYSICAL INTERPRETATION OF THE JACOBI IMAGINARY TRANSFORMATION AND THE CRITICAL DIMENSION IN DUAL MODELS. Brink, L. (CERN, Geneva); Nielsen, H. B. Phys. Lett.; 43B: No. 4, 319-322(19 Feb 1973).

It is shown that the Jacobi imaginary transformation occuring in dual loop calculations may be interpreted as a self-consistency condition obtained by assuming a complicated planar Feynman diagram formulation for strings. The self-consistency condition is derived from the intuitive condition that a "fishnet-diagram" does not change if a free side of the diagram is replaced by the wave function for a string with vacuum quantum numbers. When applying the self-consistency condition to strings for which the spectrum is built up by harmonic oscillators it is seen that the condition is only fulfilled when the number of coupling dimensions is $24 \cdot \alpha_0$ where α_0 is the intercept. (auth)

28713 ELEMENTARY PARTICLE PHYSICS. Multiparticle Aspects. Proceedings of the Eleventh International Conference, Schladming, Austria, February 21-March 4, 1972. Urban, P. (ed.). Acta Physica Austriaca, Supplementum IX. Vienna; Springer-Verlag (1972). 917p. (CONF-720224-). $62.80.

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

The seminar included 30 lectures. Separate abstracts were prepared for all lectures. (JFP)

For abstracts of individual lectures see: 28617, 28656, 28683, 28714–28718, 28741, 28742, 28755–28757, 28768–28770, 28791, 28798, 28799, 28808, 28825–28829, 28842, 28848, 29184, 29185, and 29431.

28714 SURVEY OF HIGH ENERGY INELASTIC MODELS AND KINEMATICAL CONSTRAINTS FOR INCLUSIVE PROCESSES. Predazzi, E. (Univ., Turin). Acta Phys. Austr., Suppl.; No. 9, 308-377(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

A review is given on properties of inclusive processes and some of the most widely used models for exclusive reactions. The unitarity condition, the Hagedorn thermodynamical model, properties of s-channel models and of multiperipheral models, charge conservation preserving group-theoretical model, hypothesis of equilibrium vs. nonequilibrium models, and sum rules and their implications for correlation functions for inclusive reactions are treated. (JFP)

28715 DIFFRACTIVE DISSOCIATION. Bialas, A. (Jagellonian Univ., Krakow). Acta Phys. Austr., Suppl.; No. 9, 479-493 (1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

A brief summary of results on the consequences of the absorptive character of diffractive dissociation and its relation to elastic scattering is given. The Good and Walker mechanism, diffraction excitation and diffraction production, and diffractive dissociation and inclusive spectra are covered. (JFP)

28716 ASYMPTOTIC ASPECTS OF INCLUSIVE PRODUCTION PROCESSES. Satz, H. (Univ. of Bielefeld, Ger.). Acta Phys. Austr., Suppl.; No. 9, 762-794(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

A review is given of models for the role of inclusive reactions in the asymptotic behavior of multiparticle production reactions. Inclusive single particle distributions, models and conjectures, the generalized optical theorem and applications, and the experimental situation are covered. (JFP)

28717 UNITARITY CORRECTIONS TO DUAL RESONANCE MODELS. Karpf, A. D. (Univ., Freiburg i. B.). Acta Phys. Austr., Suppl.; No. 9, 860-866(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

The results for higher-order corrections (loop terms) for the defects of lack of unitarity and pomeron incorporation in dual resonance models are summarized. Emphasis is given to the similarity between the loop and the original tree expressions. (JFP)

28718 PARTICLE PHYSICS AND EASTERN PHILOSOPHY. Capra, F. (Imperial Coll. of Science and Tech., London). Acta Phys. Austr., Suppl.; No. 9, 874-893(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

The relation between particle physics and Eastern philosophy is treated including the universe, quantum mechanics, relativity theory, field theory, the S-matrix, and bootstrap. (JFP)

28719 ATOMKERNE UND ELEMENTARTEILCHEN. (Atomic Nuclei and Elementary Particles). Bucka, H. Berlin; Walter de Gruyter and Company (1973). 726p. DM 68, -.

As an introduction to the fields of atomic nuclei and elementary particles, the text treats the nature of interactions, particle states, cross sections, and transition probabilities. The presentation of the material is addressed predominantly to those who work experimentally in this particular field and want to familiarize themselves with the basic concepts. In many places, the text uses quantitative considerations as means for an exact understanding of the processes under discussion. Aside from information about particle states, interactions, and matrix elements, experimental data are presented which define both the parameters that can be measured for a special problem and the requirements for a proper arrangement of the measuring devices. It is assumed that the reader is familiar with the basic concepts of quantum mechanics. (HBG)

28720 GELL-MANN–OKUBO MASS FORMULA IN THE LINEAR σ MODEL. Khmaladze, V. Yu. (Tomsk State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 69: No. 2, 305-308 (Feb 1973). (In Russian).

In the frame of the linear SU_3 σ-model it is proved that in a one-loop approximation the Gell-Mann–Okubo mass formula is correct up to the second order in vacuum SU_3-symmetry breaking. (auth)

Electromagnetic

Refer also to abstracts 28618 and 28641.

28721 (CONF-720582–, pp 3-12) ANALYTIC CONTINUATION OF SCALING FUNCTIONS. Menotti, P. (Scuola Normale Superiore, Pisa, Italy). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

The relation between the scaling functions measured in the deep inelastic $e^- + p \rightarrow e^- +$ anything interactions and the analogous scaling functions which should be measured in annihilation processes $e^+ + e^- \rightarrow p +$ anything are treated. (JFP)

28722 (CONF-720582–, pp 47-49) PROBLEM OF HADRON MULTIPLICITIES IN e^+e^- ANNIHILATION. Altarelli, G. (Univ., Rome). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

The annihilation structure functions in the $g\phi^3$ ladder model and in particular their asymptotic behavior when $\omega = q^2/2\nu \rightarrow \infty$, which is relevant to the behavior of the total cross section and the average multiplicity of produced particles in the limit of $q^2 \rightarrow \infty$, are studied. (JFP)

28723 (CONF-720582–, pp 101-109) ANOMALOUS ELECTROMAGNETIC CURRENTS (THEORY). Shaw, G. (Daresbury Nuclear Physics Lab., Lancs, Eng.). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

Two possible examples of anomalous electromagnetic currents the I = 2 (isotensor) and C-violating terms are treated in $\gamma + N \rightarrow \pi + N$ and $\pi + N \rightarrow \gamma + N$ interactions involving the $\gamma N\Delta(1236)$ vertex. The ideas underlying recent attempts to test the $\Delta I \leq 1$ rule are described. (JFP)

28724 POSSIBILITY OF OBTAINING A FINITE VALUE FOR THE PROTON–NEUTRON MASS DIFFERENCE. Bietti, A. (Univ., Rome); Parisi, G. Phys. Lett., B; 43B: No. 5, 427-430 (5 Mar 1973).

We discuss the possibility of evaluating the p-n mass difference unambiguously, taking in account a possible violation of Bjorken scaling law in the deep inelastic e-p, e-n scattering. We find that even a very small amount of violation is sufficient in order to obtain the correct value for the p-n mass difference. (auth)

28725 LIGHT CONE ANALYSIS OF PARTON MODEL RELATIONS. Gomberoff, L.; Horwitz, L. P. (Tel-Aviv Univ., Israel). Phys. Lett., B; 43B: No. 5, 408-410(5 Mar 1973).

The validity of relations among deep inelastic scattering structure functions originally derived by parton methods is examined from the point of view of light cone analysis. The presence of Schwinger terms in the equal time limit can be associated with violations of these relations. (auth)

28726 ELECTROMAGNETIC BACKGROUND IN THE SEARCH FOR NEUTRAL WEAK CURRENTS VIA $e^+e^- \rightarrow \mu^+\mu^-$. Brown, R. W. (Case Western Reserve Univ., Cleveland); Cung, V. K.; Mikaelian, K. O.; Paschos, E. A. Phys. Lett., B; 43B: No. 5, 403-407(5 Mar 1973).

We estimate the radiative corrections to $e^+e^- \rightarrow \mu^+\mu^-$ for several experimental situations. In particular, we discuss the asymmetry about 90° of the muon differential cross section and compare this to weak neutral current asymmetry predictions. The differences between this work and previous estimates lie in the inclusion of polarized beam effects, an exact calculation of the two-photon channel, and improved soft-photon treatment. (auth)

28727 νW_2 AT SMALL ω' AND RESONANCE FORM FACTORS IN A QUARK MODEL WITH BROKEN SU(6). Close, F. E. (Daresbury Nuclear Physics Lab., Eng.). Phys. Lett., B; 43B: No. 5, 422-426(5 Mar 1973).

The small ω' behavior of F_2^{en}/F_2^{ep} and the apparent difference in the q^2 dependences of the magnetic form factor of the proton and of the transition to $\Delta^+(1236)$ are quantitatively correlated in a model where the nucleon consists of a quark and a scalar or vector core. The proton and Δ transition form factors suggest that only the scalar core contributes at large q^2 and small ω'. As a result the ω' dependence of F_2^{en}/F_2^{ep} is obtained for $\omega' < 3$ and predictions for the weak structure functions and polarization asymmetries at small ω' are presented. We predict $F^{\nu p}/F^{\nu n} \xrightarrow{\omega' \to 1} 0$, asymmetries $\xrightarrow{\omega' \to 1} 1$ and also expect that $G_m^n/G_m^p \to -1/2$ as $q^2 \to \infty$. (auth)

28728 ADIABATIC MOTION IN A CHARGED PARTICLE TRAP. Byrne, J. (Univ. of Sussex, Brighton, Eng.). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 47-61(1972).

The adiabatic invariants associated with the motion of charged particles, trapped in electromagnetic fields with rotational and reflection symmetry, have been studied using classical methods based on the Hamilton–Jacobi equation. It has been shown that results, valid for trapping in purely magnetic configurations, may be applied in the analysis of electromagnetic charged particle traps, provided that suitably modified expressions are used for the angular frequencies in the various dynamical modes. Attention is drawn to circumstances in which the adiabatic conditions may be violated because of cancellation of electric and magnetic terms in the equations. (auth)

28729 EXACT SOLUTIONS OF THE LORENTZ–DIRAC EQUATIONS OF MOTION FOR CHARGED PARTICLES IN CONSTANT ELECTROMAGNETIC FIELDS. Heintzmann, H. (Univ., Cologne); Schruefer, E. Phys. Lett. 43A: No. 3, 287-288(12 Mar 1973).

The linearized Lorentz–Dirac equation $u^\mu = F^{\mu\nu}u_\nu - \kappa(F^{\mu\sigma}F_{\lambda\sigma}u^\lambda + \{F^{\sigma\nu}u_\nu F_{\sigma\lambda}u^\lambda\}u^\mu)$ is solved in closed form for arbitrary constant electromagnetic fields. These solutions are also a convenient starting point to treat particle motion in the slowly varying electromagnetic fields surrounding a pulsar in the near field zone. (auth)

28730 SCALING, PARTONS, AND THE LIGHT-CONE IN HIGHLY INELASTIC LEPTONIC PROCESSES. Jaffe, R. L. Stanford, CA; Stanford Univ. (1972). 155p. University Microfilms Order No. 73-4523.

Thesis (Ph. D.).

This dissertation consists of four closely related studies of the highly inelastic interactions of leptons with hadrons. First the relationship between the parton model and the analysis of singularities on the light-cone for highly inelastic leptonic processes is studied. For deep inelastic electron scattering, the parton model is shown to be a momentum space representation of any model in which free-field singularities on the light-cone are dominant. Scaling laws and sum rules derived in one approach are shown to obtain in the other with equivalent assumptions. For the production of massive muon anti-muon pairs in high energy proton–proton collisions, the two approaches are found to differ fundamentally. In the parton model, the leading singularity on the light cone is dominated in the limit of very massive pairs by the non-singular diagram in which the massive pair is created by annihilation of a parton in one proton on an antiparton in the other. Massive muon pair production therefore tests the parton model in a regime in which it is not equivalent to the light-cone approach. In Part 2 the parton model predictions are developed for the high energy photoproduction of massive muon pairs off of protons. It is shown that despite the complication of pointlike couplings between the initial photon and the partons in the proton, the dominant contribution to the production of high mass, symmetric pairs comes from parton–antiparton annihilation. This contribution is important for events where a substantial fraction of the incident photon's momentum appears in the hadronic final state and may be separated from the large background of Bethe–Heitler muon pairs. A scaling law is derived for the parton annihilation contribution which measures the as yet unexplored structure function of the photon. It is shown that the parton contribution is observable despite the experimental complication of integrating the cross section over a bremsstrahlung photon spectrum. In Part 3 the connection between the $y \cdot P$, or range, dependence of the current correlation function and the hypothesis of light-cone dominance of the inelastic electron scattering structure functions is studied. This connection is then exploited to study the rapid onset of scaling at low q^2. The regions of the q^2, ν plane and the $y \cdot P$ dependence for which the leading singularity on the light-cone dominates contributions from less singular terms with the same $y \cdot P$ dependence is studied. When the leading singularity can be shown to dominate for a particular region of q^2 and ν, the possibility of scaling for the structure function νW_2 in that kinematic region is studied. It is found that a division of the current-correlation function into short and long range contributions is fundamentally ambiguous and not related to scaling at low q^2. Short range terms, which are light-cone dominated for all q^2 as long as $\nu \to \infty$, are found but are shown not to scale at low q^2 and to be indistinguishable from corrections to long range terms which produce the leading Regge behavior. In Part 4 the possibility that pathological behavior of the current correlation function elsewhere in coordinate space might invalidate the usual arguments for light-cone dominance is examined. In particular, the relative importance in the Bjorken limit of identical singularities on the light-cone ($y^2 = 0$) and on other hyperboloids, $y^2 = a^2 > 0$ is studied. A singularity on the light-cone is shown to dominate by at least the power $\nu^{\frac{1}{2}}$ over an equivalent singularity on the hyperboloid $y^2 = a^2$ in the Bjorken limit. Moreover, the leading contribution from a singularity at $y^2 = a^2$ is shown not to scale as a power of ν multiplying a function of $x = Q^2/2M\nu$, but instead to oscillate with the (asymptotically infinite) frequency $\sqrt{a^2 M\nu(1-x)}$ in the Bjorken limit. (Diss. Abstr., Int. B)

28731 UNITARITY EQUATIONS AND MASS DIFFERENCES. Wilcox, T. J. Los Angeles; Univ. of California (1972). 84p. University Microfilms Order No. 73-1741.

Thesis (Ph. D.).

A framework for treating the problem of electromagnetic mass differences among the hadrons is developed and applied specifically to the pion and kaon mass differences. The formalism is also extended to include the low mass baryons. It proceeds from the observation that the mass difference between two adjacent members of an isospin multiplet is simply related to the zero momentum transfer (squared) matrix element of the divergence of the isospin current. A multichannel equation is obtained whose solution expresses the low mass hadron electromagnetic mass differences $m_{B^+} - m_{B^0}$ in terms of a dispersion integral involving the processes $B^+\bar{B}^0 \to \gamma\rho^+$. This method permits the natural incorporation of strong interaction effects and seems to be suited to the analysis of $\Delta I = 1$ mass differences, whereas an attempt to calculate the $\Delta I = 2$ mass differences has been unsuccessful. The phenomenological tadpole model of Coleman and Glashow emerges as a natural consequence of SU(3) symmetry in the strong interaction dynamics. (Diss. Abstr. Int., B)

28732 LIGHT-CONE ALGEBRA IN REGGE DOMAINS. Baker, H. C. St. Louis; University Microfilms Order No. 73-5023 (1972). 142p. University of Wisconsin.

Thesis (Ph. D.).

The physics of the light-cone region in configuration space is studied. Starting from first principles, with the $\lambda\phi^3$ field theory model, in a natural way an almost-canonical algebra of boson currents is unified with the formal structure of Regge theory. Mellin transform techniques are employed extensively to analyze the asymptotic features of the model. The first investigations are concerned with the single-particle matrix elements of current products, specializing in the matrix element relevant to inclusive electroproduction, and exploring whether the algebra defined by leading light-cone singularities in the current products may be applicable in the deep Regge domain. This applicability is affirmed, and it is found that Bjorken scaling is obtained in the inclusive structure function νW^2. A sufficient condition is found to be the presence of fixed poles in the angular momentum plane. Comparison with other models suggests that this may also be a necessary condition. The inclusive structure function W_1 vanishes in the deep Regge domain, in accordance with the Callan–Gross theorem. The vanishing is as $\ln q^2/q^2$, however, rather than canonically as $1/q^2$. The noncanonical $\ln q^2$ term is a direct consequence of the presence in the model of J-plane dipoles in W_1 in the angular momentum plane. The deep scaling region is also investigated, and it is found that the amplitudes in this domain exactly interpolate the amplitudes in the deep Regge domain, including constant factors as well as the noncanonical $\ln q^2$ factor in W_1. The above considerations are extended subsequently to multi-particle matrix elements of products of weak currents. Two-particle matrix elements are considered in detail, especially those relevant for lepton-pair production and semi-inclusive electroproduction. It is established within the model that the leading-singularity algebra continues to be applicable in generalized deep Regge domains. The leading singularity is shown to carry now some dependence on additional hadronic subenergies, however, so that complete scale-invariance is broken by the strong interactions. Interpolating limit sequences are established, and subsequently employed to distinguish scales set by the strong interactions. (Diss. Abstr. Int., B)

28733 BOUND STATE AND SCATTERING PROBLEMS FOR PARTICLES WITH ELECTRIC AND MAGNETIC CHARGES. Salamo Schijman, S. Boulder, CO; Univ. of Colorado (1972). 108p. University Microfilms Order No. 73-1823.

Thesis (Ph.D.).

First the bound state energy spectrum of a dyon moving in the field of another fixed dyon is investigated using group theoretic techniques. The following Hamiltonians are treated: (a) the Pauli-like Hamiltonian, and (b) the O(4)-symmetric Hamiltonians. Further, an anomalous magnetic moment and an intrinsic electric dipole moment to the dyons are introduced and solved for the energy spectrum in the Pauli approximation. Secondly, the non-relativistic scattering amplitude for dyon–dyon scattering with an extra $1/r^2$-potential (of Zwanziger), is evaluated, using the dynamical group O(4,2). The same problem is solved by the "spin method" of Goldhaber. Finally, the more realistic scattering problem of two dyons without any ad hoc extra potential is solved. (Diss. Abstr. Int., B)

28734 MULTIPLICITIES IN LEPTON–HADRON PROCESSES. Cahn, R. N.; Cleymans, J. W.; Colglazier, E. W. (Stanford Univ., CA). Phys. Lett.; 43B: No. 4, 323-326(19 Feb 1973).

The average multiplicity in deep inelastic electro- and neutrino-production at large $\omega(\omega \sim s/Q^2 + 1)$ is related in Feynman's version of the parton model to the average multiplicities in high-energy electron-positron annihilation and hadron–hadron scattering. The relation is: $\langle n(s,Q^2)\rangle_{eP,\nu P} \sim C_{e^+e^-} \ln(Q^2/M_{1\perp}^2) + C_h \ln(\omega - 1)$, where $C_{e^+e^-}$ and C_h are, respectively, the coefficients of $\ln(s/M_{1\perp}^2)$ in the multiplicities from e^+–e^- and P–P into hadrons, and $M_{1\perp}$ is an average transverse mass. (auth)

28735 AZIMUTHAL DEPENDENCE OF SEMI-INCLUSIVE, DEEP INELASTIC ELECTROPRODUCTION CROSS SECTIONS. Ravndal, F. (California Inst. of Tech., Pasadena). Phys. Lett.; 43B: No. 4, 301-303(19 Feb 1973).

It is pointed out that according to the parton model, there should be no dependence on the azimuthal angle in the cross section for deep inelastic, semi-inclusive electroproduction with one detected hadron in the final state. (auth)

28736 QUANTUM TRANSITIONS OF RELATIVISTIC ELECTRONS IN A SUPERSTRONG MAGNETIC FIELD. Sokolov, A. A.; Zhukovskii, V. Ch.; Nikitina, N. S. (Moscow State Univ.). Phys. Lett.; 43A: No. 1, 85-86(12 Feb 1973).

The probability of emission of a hard γ-quantum in relativistic electron transitions to the ground (or near it) level in a magnetic field $H \sim H_0 = m^2c^3/e_0\hbar \approx 4.41 \times 10^{13}$ G is obtained. For the inverse transitions from these levels the cross section of electron photoexitation is calculated. (auth)

28737 INFLUENCE OF INTERFERENCE ON THE INTENSITY OF TRANSITION X-RADIATION IN A LAYERED MEDIUM. Nikolaenko, V. I.; Slavatinskii, S. A.; Chirochkin, V. S.; Shaulov, S. B. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 16: No. 11, 430-435(5 Dec 1972).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 16: No. 11, 610-614(5 Dec 1972).

The intensity of the transition radiation produced when a charged particle passes through a layered medium both at relatively low energies and at the Lorentz factor value, at which an appreciable influence of the interference is predicted, is studied. It is concluded that the dependence of the radiation intensity on the Lorentz factor γ is nonlinear in a wide range. At low values of γ the intensity of the radiation increases linearly with γ, but saturation sets in already at $\gamma = 10^4$. (JFP)

28738 UNIFIED GAUGE THEORIES OF WEAK AND ELECTROMAGNETIC INTERACTION. Ioffe, V. L.; Nikolaev, N. N. (Inst. of Theoretical and Experimental Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 17: No. 1, 43-46(5 Jan 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 1, 59-62(5 Jan 1973).

A unified model of weak and electromagnetic interactions with spontaneous violation of gauge invariance was proposed by Glashow and Georgi without neutral currents and without anomalies connected with the axial current. It is shown that the Glashow–Georgi model is unequivocally refuted by the experimental data on $K_L \to 2\mu$ decay. In addition, a number of problems connected with the duplication of the experimentally observed SU(3) symmetry of strong interactions in models of the Glashow–Georgi type. (LBS)

28739 SPECTRUM AND POLARIZATION OF MAGNETO-BREMSSTRAHLUNG AT STRONG RADIATION DAMPING. Gal'tsov, D. V.; Losev, V. A. (Moscow State Univ.). Yadern. Fiz.; 17: No. 1, 109-112(Jan 1973). (In Russian).

To observe radiation damping it is proposed to measure the spectrum of the total emission of a relativistic electron, moving in a uniform magnetic field without energy supply. The calculations, carried out on basis of classical Lorentz–Dirac equation, predict independence of the position of the peak in spectrum distribution of bremsstrahlung upon electron initial energy. The curves for radiation polarization depending on frequency at different values of electron initial energy are presented. (auth)

28740 CONTRIBUTION TO THE WAVE MECHANICS OF THE PARTICLE OF MAXIMUM SPIN 1. Pereira, J. V. Port. Phys.; 6: No. 4, 203-303(1971). (In French).

Thesis.

A generalization of the theory of the spin maximum 1 particle is proposed which enables the theory to describe a charged particle moving in an electromagnetic field. The general problem of passing from the relativistic theories to the corresponding nonrelativistic ones is then discussed, in which we stress the importance of the "β-approximation." One then calculates the nonrelativistic approximation of the foregoing generalized theory of the particle of spin maximum 1, which brings to light the validity of the so-called "method of the fusion" within the frame of non-relativistic wave mechanics. As a particular case of the preceding results, we are led to the approximation of the Maxwell-de Broglie equations, describing the non-relativistic behavior of the photon. (auth)

28741 CURRENT TOPICS IN THE ELECTROMAGNETIC INTERACTIONS OF HADRONS. Moffat, J. W. (Univ. of Toronto). Acta Phys. Austr., Suppl.; No. 9, 605-699(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

A review is given of the phenomenological applications to the electromagnetic interactions of hadrons. Compton scattering and electroproduction, scale invariance and the Bjorken limit, crossing symmetry and $e^+ + e^-$ annihilation, Regge poles in Compton scattering, structure function relations, analyticity properties of Compton scattering, finite-energy sum rules and angular momentum singularities, fixed poles, angular momentum cuts, finite-energy sum rules are covered. Also treated are Compton scattering differential cross sections, Regge models of T_1 and T_2, results for $\gamma + p$ and $\gamma + n$ scattering, factorization in pion Compton scattering, results for $e^+ + e^-$ annihilation, local sum rule and elastic form factors, proton–neutron mass difference, formula for self-mass, and scale invariance breaking and convergence properties of ΔM. (JFP)

28742 EXOTIC APPLICATIONS OF LIGHT-CONE ALGEBRA. Callan, C. G. Jr. (Inst. for Advanced Study, Princeton, NJ). Acta Phys. Austr., Suppl.; No. 9, 700-732(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224–.

In these lectures the light-cone algebra for inequalities on the total inelastic cross sections and extensions of the model to semi-inclusive cross sections are treated. The light-cone algebra, positivity conditions, and semi-inclusive reactions are considered. (JFP)

28743 BREMSSTRAHLUNG DURING COLLISION OF HIGH-ENERGY PARTICLES IN A MAGNETIC FIELD. Baier, V. N.; Katkov, V. M. (Inst. of Nuclear Physics, Novosibirsk, USSR). Dokl. Akad. Nauk SSSR; 207: No. 1, 68-70(1 Nov 1972). (In Russian).

The bremsstrahlung occasioned by the collision of two electrons or of an electron and a positron moving in a magnetic field was considered. The method of equivalent photons was used, in which it was easy to allow for an external magnetic field in the space-time picture. The external field acts in various ways on the emissive electron and recoil electron. (KSW)

28744 DEPENDENCE OF THE PHOTODISINTEGRATION CROSS SECTION ON THE OFF-SHELL T-MATRIX. Van Dijk, W.; Razavy, M. (Univ. of Alberta, Edmonton). Nucl. Phys.; A204: No. 2, 412-426(1973).

Nucleon–nucleon scattering phase shifts determine the diagonal element of the transition matrix. The off-diagonal elements are not completely arbitrary but have conditions imposed on them by the range and the tail of the potential. Electromagnetic interaction can also be used to place restrictions on the off-diagonal elements. We find that the cross section of the deuteron photodisintegration is sensitive to the off-shell transition matrix. The integrated cross section can be varied by as much as 30% or more, and the matrix element for the E1 transition by a factor of 2. While the matrix element for the photodisintegration depends on the off-shell elements of the T-matrix, it cannot be used to discriminate between alternative off-shell T-matrices. We have constructed classes of different off-shell T-matrices, which produce identical photodisintegration cross sections and other two-body scattering and bound-state properties. (auth)

28745 SPATIAL DISTRIBUTION OF ELECTRONIC COMPONENT OF EXTENSIVE AIR SHOWERS. Dymova, I. A.; Kalmykov, N. N. (Moscow State Univ.). Yadern. Fiz.; 17: No. 1, 104-108(Jan 1973). (In Russian).

For sea level within the distance range from 1 to 800 m by the Monte-Carlo method there have been obtained functions for electron space distribution in extensive air showers of moderate energies. Density fluctuations at various distances from the shower axis have been studied, and the electron component space distribution in the shower with a fixed number of electrons has been obtained. It is shown, that space distribution function is not described by one parameter s. (auth)

28746 RADIATIVE DECAYS OF MESONS. Gourdin, M. (CERN, Geneva). pp 219-233 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The radiative decays $P \to \nu\gamma$, $V \to p\gamma$, and $P \to V\gamma$ are discussed from the standpoint of finding a convenient framework for such a study in the broken SU(3) symmetry. In the SU(3) theory of electromagnetic interactions the assumptions made for the photon are: (a) the photon is a U spin scalar, and (b) the photon belongs to an adjoint representation of SU(3). The 2γ decay of π^0, η^0, and X^0 and the decays $\phi \to \pi^0 + \gamma$ and $\phi \to \eta^0 + \gamma$ are studied on a theoretical and experimental basis. The vector meson dominance model is used to study the relation between the vertices $Pv\gamma$, $PV\gamma$, and PVV. Radiative decay widths of mesons are computed and are compared with experiment. (LBS)

28747 HADRON PRODUCTION IN e^+e^- COLLISIONS FROM THE TAIL OF THE ρ, ω and ϕ MESONS. Layssac, J.; Renard, F. M. (Faculte des Sciences, Montpellier, France). pp 499-504 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A model based on the conventional vector dominance model is presented for multihadron production in e^+e^- collisions. The model is applied to the production of pions (4π, 5π and 6π) η + pions, and $K\bar{K}$ + pions at the c. m. energy $E < 3$ GeV. Cross sections for these reactions are calculated as functions of energy. The total hadronic production cross section is also presented. (LBS)

28748 HADRON PRODUCTION THROUGH PHOTON–PHOTON COLLISIONS IN ELECTRON–POSITRON STORAGE RINGS. Kessler, P. (Coll. de France, Paris). pp 513-526 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The continuation of the theoretical work performed on photon–photon collisions in electron–positron storage rings is reported. Five parameters on which the cross-section measurements for reactions of the type $e^-e^+ \to e^-e^+A^-A^+$ (where A = e, μ, π, K, ...) should depend are discussed. The reactions $e^+e^- \to e^-e^+X$, $X = 2\gamma$ (where $X = \pi^0$, η, or η') are considered, which are also to be analyzed as photon–photon collisions. (LBS)

28749 ELECTROMAGNETIC PRODUCTION OF VECTOR MESONS ON NUCLEONS. Schmitz, D. (Univ., Bonn). pp 529-541 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The present status of photoproduction of vector mesons on nucleons is reviewed. The large similarity observed between photoproduction of hadrons and hadronic relations is discussed. A comparison of data on the photon absorption cross section on protons and the total π^0p cross section is shown. The similarity between photon reactions $\gamma p \to \pi^0 p$ and $\gamma p \to \eta p$ and charge-exchange reactions $\pi^- p \to \pi^0 n$ and $\pi^- p \to \eta n$ is also shown. The diffractive character of the photoproduction of vector meson is discussed in terms of the vector dominance model. The combined vector dominance model and quark model predictions for the differential cross section for ρ and ϕ photoproduction are shown to be in good agreement with experimental data. (LBS)

28750 DIPION PHOTOPRODUCTION. Frampton, P. H. (CERN, Geneva). pp 543-555 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The photoproduction of two pions in the process $\gamma + X \to \pi^+ + \pi^- + X$ is discussed, where X is a proton or a complex nucleus. In particular the suppression of dipion (ρ') production for high dipion mass, $m_{\pi\pi} = (1 \sim 2)$ GeV, is discussed. The experimentally observed small ratio for the Pomeron (P) couplings $g_{\gamma P\rho'}/g_{\gamma P\rho}$ are explained in terms of a multiperipheral (Drell) production mechanism; it is further pointed out that this result has no implication for the ratio $g_{\gamma\rho'}/g_{\gamma\rho}$. (LBS)

28751 MODEL FOR HADRON PRODUCTION IN e^+e^- COLLISIONS. Wataghin, V. (Univ., Turin). pp 557-560 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A model where vector meson resonances are parametrized according to second-order pole expressions is used to show that crossing symmetry and a simple assumption for the asymptotic s-dependence or the structure functions W_1, W_2, lead to a definite prediction for the q^2-dependence of σ_{tot} for the reaction $e^+ + e^- \to \bar{p} +$ anything. In view of the colliding beam experiments at Adone, the model's prediction for the reaction $e^+ + e^- \to \bar{p} + p$ as a function of $q^2 = 4E^2$ is also presented, where E is the c.m. energy of each beam. (LBS)

28752 SU_3 SYMMETRY BREAKING IN RADIATIVE MESON DECAYS. Singer, P. (Technion-Israel Inst. of Tech., Haifa). pp 581-590 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The vector-meson dominance approach to the problem of radiative decay of vector and pseudoscalar mesons is reviewed. An effective Lagrangian with vector gauge fields and current mixing is used, and allowance is made for the most general form consistent with octet-broken SU(3) for the VVP interaction term of the Lagrangian. New information available from the measurements on the $\phi \to \eta\gamma$ and $X^0 \to 2\gamma$. The calculated values of the decay rates are compared to experimental results. (LBS)

Weak

Refer also to abstract 28844.

28753 VALENCE QUARK DOMINANCE IN INELASTIC NEUTRINO INTERACTIONS. Rein, D. (Technische Hochschule, Aachen). Phys. Lett.; 43B: No. 3, 209-212(5 Feb 1973).

Scaling observed in neutrino nucleon interactions at relatively low energies and not too small $x = -q^2/2 M_p\nu$, is attributed to elastic $\nu(\bar{\nu})$ scattering off three point-like, left handed Zweig-Gell-Mann valence quarks with low effective mass. The model predicts total inelastic cross sections all in agreement with available experiments. (auth)

28754 NEUTRON–NEUTRON INTERACTION AND POSSIBLE OFF-SHELL EFFECTS IN MUON CAPTURE BY DEUTERONS. Sotona, M.; Truhlik, E. (Inst. of Nuclear Physics, Rez, Czech.). Phys. Lett.; 43B: No. 5, 362-364(5 Mar 1973).

Dramatic changes in the doublet transition rates have been found due to the off-shell effects in a class of phase-shift-equivalent potentials. The comparison of potential approach with the Omnès-Muskhelishvili method is performed. (auth)

28755 $K_L^0 \to \mu^+ + \mu^-$ PUZZLE. Oakes, R. J. (Northwestern Univ., Evanston, IL). Acta Phys. Austr., Suppl.; No. 9, 272-282 (1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The naive theoretical lower bound on the $K_L^0 \to \mu^+ + \mu^-$ branching ratio exceeds the present experimental upper limit. Possible causes and consequences of this puzzle are discussed. (auth)

28756 REVIEW OF THE STATUS OF K_{l3} FORM FACTORS. Gaillard, M. K. (CERN, Geneva). Acta Phys. Austr., Suppl.; No. 9, 283-307(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The review of the form factors for $K_{l3} \rightarrow \pi + l + \nu$ decay emphasizes the importances of these form factors in relation to strong interaction symmetries. The Cabibbo theory and parametrization of the form factors, the soft pion theorem, and experiment are discussed. (JFP)

28757 TWO-COMPONENT ALTERNATIVE TO DIRAC'S EQUATION. Biedenharn, L. C. (Univ., Karlsruhe, Ger.). Acta Phys. Austr., Suppl.; No. 9, 837-846(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

It is shown that there exists a two-component first-order differential equation for a massive charged lepton having the standard electromagnetic interaction but lacking a sharp parity. (JFP)

28758 TRANSPORT COEFFICIENTS OF A NEUTRINO GAS. van Leeuwen, W. A.; de Groot, S. R. (Univ., Amsterdam). Lett. Nuovo Cim.; 6: No. 12, 470-472(24 Mar 1973).

The coefficients in a series of associated Laguerre (Sonnie) polynomials are developed for a neutrino gas. (JFP)

28759 ACCURATE FERMI β DECAY MEASUREMENTS AND THE MAGNITUDE OF THE WEAK INTERACTION VECTOR COUPLING CONSTANT. Freeman, J. M. (Atomic Energy Research Establishment, Harwell, Eng.); Clark, G. J.; Ryder, J. S.; Burcham, W. E.; Squier, G. T. A.; Draper, J. E. pp 105-111 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The paper is mainly concerned with the magnitudes of the coupling constants in weak interactions. The fundamental weak-interaction coupling constant, G, calculated from muon decay data, is well defined; but there still remains some uncertainty in the magnitudes of the beta-decay coupling constants, G_β^V and G_β^A. It is considered that the magnitude of G_β^V is likely to lie between $(1.4102 \pm 0.0012) \times 10^{-49}$ and $(1.3999 \pm 0.0014) \times 10^{-49}$ erg cm^3, the former value having been derived from Fermi beta-decay data with conventional radiative corrections and the latter having been derived from K_{e3} data. The true value depends on theoretical interpretations and the question of the intermediate vector boson. The magnitude of G_β^A depends largely at present on the value of the neutron half-life. (UK)

28760 ABSORPTION OF AN ANTINEUTRINO BY A POLARIZED ELECTRON. Yakh'yaev, R. Sh. Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk; No. 2, 93-99(1972). (In Russian).

The cross section of formation of a hadron pair during an antineutrino-electron interaction was calculated. Experimental investigation of such processes may give information on the direct neutrino-lepton interaction. Starting points for the development were the pion pair formation: $\bar{\nu} + e \rightarrow \pi^- + \pi^0$, and the baryon pair formation: $\bar{\nu} + e \rightarrow n + \bar{p}$. (KSW)

28761 EQUIVALENCE OF THE YUKAWA AND THE FOUR-FERMION INTERACTIONS. I. Gadzhiev, S. A. Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk; No. 2, 89-92(1972). (In Russian).

The question of the equivalence between the Yukawa and the four-fermion interactions was considered in a low order of the theory of perturbation for scalar and for pseudoscalar variants. Such equivalence was demonstrated for the case in which $I \rightarrow 0$ ($q \rightarrow M$) and $q = G^2/2M^2$, where q in the radius, M is the mass of a boson, and G is the constant of interaction. (KSW)

Strong (General)

Refer also to abstract 28815.

28762 (FRNC-R-16, pp 32-57) CERTAIN ASPECTS OF VERY HIGH ENERGY HADRON PHYSICS. Poulet, M. 1972. (In French).

From Colloquium on high energy interactions; Aussois, France (20 Mar 1972).

The phenomenology of high energy strong interactions (exchange processes, Regge poles and trajectories, pomeron contribution are briefly reviewed. Results obtained for P.lab > 25 GeV/c are presented. Experiments envisaged in the near future (hadrons at NAL) and in the longer term (hadrons at CERN in 1976) are examined. (France)

28763 MEAN MULTIPLICITIES OF SECONDARIES IN HADRON-HADRON INTERACTIONS. Grishin, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 17: No. 1, 134-139(Jan 1973). (In Russian).

For the process of hadron multiple production relations between the values of mean multiplicity of different secondaries were derived which follow from isotopic and charge invariance, strangeness conservation laws, electric and baryon charges. These ratios can be used to check isotopic and charge invariance for superhigh energies, as well as to obtain information on nature of secondaries. Similar relations were obtained for the limiting fragmentation model. (auth)

28764 DUAL MODEL WITHOUT TACHYONS, POSSESSING VIRASORO SYMMETRY AND SIMPLE LOOP GRAPHS. Loktionov, M. V.; Nesterov, M. M. (Leningrad State Univ.). Yadern. Fiz.; 17: No. 1, 150-162(Jan 1973). (In Russian).

From Neveu-Schwarz theory there has been singled out a subtheory free of tachyons single loop unitary corrections are being calculated. The basic properties of the model and its possible interpretation are discussed. (auth)

28765 FRAGMENTATION AND MULTIPERIPHERAL DYNAMICS: A CONNECTION THROUGH UNITARITY. Neff, T. L. (Univ. of California, Berkeley). Phys. Lett. 43B: No. 5, 391-396(5 Mar 1973).

A rapidity space decomposition of s-channel unitarity implies interdependence between production mechanisms. The presence of a low multiplicity diffractive production channel shadows the multiperipheral mechanism while the high multiplicity multiperipheral channel shadows the diffractive mechanism in the high produced mass region. The first effect results in negative contributions to the effective two-pomeron cut. Pomeron couplings to elastic and inelastic channels then require a cut structure which evades decoupling theorems. For hard cuts there is a connection between the relative amount of diffractive production and the dip in $d\sigma_{el}^{PP}/dt$ at $-t = 1.2$ GeV^2/c^2 at ISR. The consequent cut to pole strength is 10 to 20%. It is conjectured that the situation described resembles the approach to a phase transition in the multiperipheral gas. (auth)

28766 CONNECTION BETWEEN ANALYTICITY AND REGULARIZATION WITHIN THE FRAMEWORK OF THE LEE MODEL. Tataru-Mihai, P. I. Stud. Univ. Babes-Bolyai, Ser. Phys.; 17: No. 2, 17-22(1972).

The connection between analyticity and regularization is discussed in the framework of the one-heavy-particle sector of the Lee model. (LBS)

28767 CORRELATIONS IN THE MULTIPERIPHERAL MODEL AND RESONANT PARTICLE PRODUCTION. Gendenshtein, L. E. (Physical-Technical Inst., Kharkov). JETP Lett. (USSR) (Engl. Transl.); 17: No. 1, 26-29(5 Jan 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 1, 37-41(5 Jan 1973).

An investigation was made of the correlations in multiple particle production processes in the multiperipheral model, taking into account the resonant production of particles. The predictions of the multiperipheral model are found to be in agreement with data. It is noted that a similar analysis in the pionization model leads to disagreement between theory and data. (LBS)

28768 LOW ENERGY ASPECTS OF BROKEN SCALE INVARIANCE. Kleinert, H. (Freie Univ., Berlin). Acta Phys. Austr., Suppl.; No. 9, 533-604(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

By investigating the low energy properties of some hadron vertices, some evidence is obtained for an appropriate scale invariance of the world. The dilatation current and its basic properties, δD domination by single scalar meson, Ward identities for the $\delta D\pi\pi$ vertex and the theorem about a subtraction in q^2, the size of the Σ term, dimensional properties of the Hamiltonian density, Lagrangian models for scale invariance, and scale properties of the linear sigma model are treated. (JFP)

28769 QUARKS. Gell-Mann, M. (CERN, Geneva). Acta Phys. Austr., Suppl.; No. 9, 733-761(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

Lectures are given on two interpretations of the concept of quarks for hadrons and the possible relations between them. These interpretations are quarks as constituent quarks and current quarks. (JFP)

28770 DIVERGENCE-FREE EXAMPLE OF INTERACTION CONSTITUTING A DYNAMICAL MODEL OF QUARKS AND HADRONS. Rayski, J. (Jagellonian Univ., Krakow). Acta Phys. Austr., Suppl.; No. 9, 870-873(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The theorem is proven that if the first and second derivative of the interaction Lagrangian with respect to its argument are bounded then there exist unique solutions of the field equations for any value of the coupling constant and any finite time interval. Integral numbers which appear in the quantization are called the numbers of quarks. The clusters of the field acquire a quantum theoretical counterpart, namely bound states of two or more quarks called hadrons. The form and properties of the interaction Hamiltonian are also discussed. (JFP)

28771 EVIDENCE FOR REGGE POLES AND HADRON COLLISION PHENOMENA AT HIGH ENERGIES. Chiu, C. B. (Univ. of Texas, Austin). Annu. Rev. Nucl. Sci.; 22: 255-316 (1972).

The experimental evidence for Regge trajectories is reviewed. A critical evaluation of the various absorption models is given, and a strong central absorption prescription for high energy two-body scattering is suggested. High energy two-body collision phenomena are reviewed, and the successes and failures of the Regge pole model are correlated to the low impact parameter behavior of the pole terms. (JFP)

Strong (Baryon No. = 0)

Refer also to abstracts 28689 and 28692.

28772 BOUND QUASINUCLEAR STATES OF 2N2 ANTI N SYSTEM. Birger, E. S.; Kerbikov, B. O.; Konyukhova, N. B.; Shapiro, I. S. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 17: No. 1, 178-185(Jan 1973). (In Russian).

It is shown, that there should exist narrow nonrelativistic bound states of quasinuclear type in the system of two nucleons and two antinucleons. The spectrum of masses and annihilation widths of the states with $I^G(J^P) = 2^+(4^+)$ quantum numbers is obtained. One of the obtained values is of 34 MeV width and therefore it should experimentally be observed as a two-charged meson in X-region. (auth)

28773 ANALYSIS OF Kπ-INTERACTION IN THE ENERGY RANGE UP TO 1 GeV. Isaev, P. S.; Khleskov, V. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 17: No. 1, 163-169(Jan 1973). (In Russian).

Analysis of Kπ-interaction in the energy range up to 1 GeV was performed with the help of dispersion relations for s- and p-waves. A set of $\delta_0^{\frac{1}{2}}$, $\delta_0^{\frac{3}{2}}$, $\delta_1^{\frac{1}{2}}$ phase shifts simultaneously satisfying dispersion relations, was found. Resonance behavior of $\delta_0^{\frac{1}{2}}$ phase shift in $M(K\pi) \sim 1.1$ GeV region is predicted. (auth)

28774 RHO-DOMINANCE AND BOOTSTRAP IN ππ-SYSTEM. Vall, A. N.; Dedushev, V. S.; Serebryakov, V. V. (Inst. of Mathematics, Moscow). Yadern. Fiz.; 17: No. 1, 126-133(Jan 1973). (In Russian).

A simple model for partial s- and p-waves of ππ-scattering, based on the notion of vector dominance is proposed. It is shown that ρ-meson exchange in the crossing-channel generates resonance in the channel with isospin I = 0(ϵ-meson) with the mass m_ϵ = 950 MeV and ϵ-meson exchange generates ρ-meson. The condition of "mutual bootstrap" together with KSFR relation leads to the result $m_\rho^2 = 8\pi^2 f_\pi^2$, which agrees well with the experiment. The only parameters of the model are pion mass and decay constant f_π^2. A calculation of K_1^0 and K_2^0 meson mass differences is presented in the appendix. (auth)

28775 SOME NEW APPLICATIONS OF RELATIVISTIC INVARIANCE TO CLASSICAL PARTICLE MECHANICS AND ELEMENTARY PARTICLE SCATTERING THEORY. Shukre, C. S. Pittsburgh; Univ. of Pittsburgh (1972). 106p. University Microfilms Order No. 73-4993.

Thesis (Ph. D.).

In the first part of the thesis a new method is proposed for constructing examples of relativistically invariant dynamics of classical particles. Introducing the Poincaré group and the space reflections as transformations of position and velocity variables of two free particles, nonlinear equations for the Lorentz covariant position variables of two interacting particles are derived. Advantages of this method are that it does not couple the position variables of the interacting particles in the nonlinear equations, and the solutions yield the particle world lines directly. Solutions are obtained in a special case. Proof of a theorem which states that the total kinematic linear and angular momenta cannot be conserved in a Poincaré invariant theory is extended to the case of three particles. In the second part the two-variable expansions of the scattering amplitudes in terms of the irreducible representations of the Lorentz or the four-dimensional orthogonal group are generalized to the reactions involving particles with arbitrary spin. The expansions are shown to have proper threshold and pseudothreshold behavior. They are also used for a phenomenological analysis of the Dalitz plot of the reaction $\bar{p}n \to 3\pi$. The method is compared with other fitting procedures. (Diss. Abstr. Int., B)

28776 FRESH LOOK AT EXOTICS. Faiman, D.; Goldhaber, G.; Zarmi, Y. (CERN, Geneva). Phys. Lett.; 43B: No. 4, 307-310(19 Feb 1973).

Simple quark model considerations suggest that the least massive exotic mesons and baryons may occur close to the nucleon-antinucleon and nucleon-nucleon-antinucleon thresholds respectively. The fact that such channels are energetically open for the decay of these exotics means that both production and decay can proceed via allowed duality diagrams. We suggest three specific reactions which may permit their detection. (auth)

28777 REMARKS ON A SELF CONSISTENT FIELD THEORY OF EXTRA STRONG INTERACTIONS. Burt, P. B. (Clemson Univ., SC); Chervenak, W. S. Czech. J. Phys.; 23: No. 2, 279-281(1973).

The interactions of baryons and antibaryons through a pseudoscalar field were considered on the basis of a model in which an ensemble of baryons and antibaryons are excited from the vacuum. The resulting interactions were attributed to fluctuations in the uniform sea of particles and antiparticles. An attempt is made to clarify the physical basis of the model and to point out some new results. Specifically it is shown that the infinite renormalization of the meson mass is independent of quantization of the meson field and arises as a result of perturbation theory only. It is also pointed out that this model may be applied directly to the case of particles more massive than nucleons. (LBS)

28778 Kπ INTERACTIONS. Henri, V. P. (CERN, Geneva). pp 3-24 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The search for a scalar Kπ resonance by a CERN-Brussels-UCLA Collaboration, which led to a phase shift analysis of the Kπ system is described. The results are compared to the Kπ phase shifts obtained by a group from Johns Hopkins University and to the theoretical phase shifts obtained by Lovelace with the Veneziano model. The results of off-mass shell Kπ scattering phase shifts obtained by a collaboration between Argonne National Laboratory and the University of Chicago are shown. (LBS)

28779 δ, S*, $K\bar{K}$ THRESHOLD. All Nonstrange Mesons of Mass Around 1000 MeV. Beusch, W. (CERN, Geneva). pp 63-73 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A review is given of the evidence for the simplifying assumption that all data on δ, $\pi_N(1016)$, and $\eta_{\theta+}(1060)$ can be explained by the existence of an I = 1 and I = 0 resonance, both having $J^P = 0^+$. Evidence for the M(953) is mentioned. (LBS)

28780 ω-ρ INTERFERENCE. Marshall, R. (Daresbury Nuclear Physics Lab., Eng.). pp 101-124 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A review is given of theoretical and experimental evidence of ω-ρ interference from πN, pp, and photoproduction interactions involving ππ and ee final states. Mass spectra and cross section data are presented. Photoproduction and storage ring data for the ππ final state are compiled, from which the branching ratios for $\omega \to 2\pi$ and $\rho \to 2\pi$ are obtained. (LBS)

28781 INTERMEDIATE MASS BOSONS. French, B. R. (CERN, Geneva). pp 275-292 of Meson Resonances and Related

Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A survey is made of experimental data on the production of E^0, F_1, and R-region resonances. (LBS)

28782 $\pi\pi$ SCATTERING, NONLINEAR REALIZATIONS OF CHIRAL $SU_2 \times SU_2$ AND THE $M_o \to \infty$ LIMIT. Alles, W.; Mazzanti, P.; Salvini, M. (Univ., Bologna). pp 563-568 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The $\pi\pi$ scattering lengths are studied in a Lagrangian model theory. The consequences in the tree approximation of the most general $SU(2) \times SU(2)$ invariant Lagrangian broken by a σ term leading to PCAC are studied, when the renormalizability condition is dropped from the beginning. (LBS)

28783 HARMONIC OSCILLATOR PATTERN ARISING FROM AN ALGEBRAIC APPROACH TO CHIRAL SYMMETRY. Buccella, F. (CERN, Geneva). pp 569-571 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

A program is described that makes use of the $SU(4) \times O(3)$, which arise from the fact that the lowest meson states may be classified in the $15 + 1$ $L = 1$ representations, to build upon axial charges satisfying the AW sum rules and the superconvergence relation following from the vanishing at infinite energy of the amplitudes with exotic t channel internal quantum numbers. (LBS)

28784 ADLER ZERO IN THE CHEW-LOW EXTRAPOLATION OF $\pi\pi$ AND πN IN OPE REACTIONS. Benecke, J.; Wagner, F. (Max Planck-Institut fuer Physik und Astrophysik, Munich). pp 573-580 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

The Adler self-consistency condition and the assumption of minimal dependence of the amplitude on Δ^2 is applied to $\pi\pi$ and πN scattering. It is shown that for low masses the way in which the on-shell values are approached depends on the scattering lengths. The possible influence of absorption on the observed zeros in $\pi^+\pi^-$ and $\pi^+ p$ is discussed. (LBS)

Strong (Baryon No. = 1)

Refer also to abstract 28678.

28785 (FRNC-TH-338) ABSORPTION AND EXCHANGE DEGENERACY IN $\pi N \to K\Lambda$ AND $\pi N \to K\Sigma$ REACTIONS. Girardi, G. (Aix-Marseilles Univ. (France)). 1971. 79p. (In French). Dep. NTIS (U. S. Sales Only) $6.00.

Thesis.

A phenomenological model applicable to hypercharge exchange reactions was studied. A particular absorption model with exchange degeneracy which takes into account duality is presented. The formulation and the results of the Regge model are re-established and the consequences of the duality and factorization constraints on a single pole model are shown. The degenerate pole absorption model satisfactorily explains the experimental results for anti $KN \to \pi\Sigma/\Lambda$ and $\pi N \to K\Sigma/\Lambda$ reactions as the polarizations obtained are generally good. The model is interesting because of the small number of parameters involved, these parameters confirming its validity. It is possible to obtain better results by including parameters such as the various Λ factors associated with the amplitudes (flip or flop) of the variable residues and the transfer, although it is difficult to justify the introduction of adequate parameters. (France)

28786 ISOSPIN ANALYSIS OF INELASTIC PION-NUCLEON SCATTERING IN THE ENERGY RANGE 300 TO 500 MeV. Makarov, M. M.; Obrant, G. Z.; Sarantsev, V. V. (Inst. of Nuclear Physics, Leningrad). Yadern. Fiz.; 17: No. 1, 170-177 (Jan 1973). (In Russian).

Relations of the type of inequalities for the cross section of $\pi N \to \pi\pi N$ reactions were obtained proceeding from the hypothesis on isospin invariance. The experimental data on the cross sections for these reactions in the energy range 300 to 500 MeV were analyzed. The modulus of isospin amplitudes and interference angles are determined, predictions on the cross section value are made. (auth)

28787 AMPLITUDE OF PION-DEUTERON SCATTERING IN $\Delta(1236)$ RESONANCE ENERGY RANGE. Kolybasov, V. M.; Kudryavtsev, A. E. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 17: No. 1, 42-51(Jan 1973). (In Russian).

An expression for πd-scattering amplitude in the energy range close to the $\Delta(1236)$ resonance was obtained by summing an infinite series of nonrelativistic Feynman diagrams. The obtained expression takes into account all the effects of pion rescattering on deuteron nucleons and p-wave character of πN-interaction at energies considered. The estimation of the corrections for the obtained formula shows, that they have ν_N/ν_π order of magnitude, where ν_N and ν_π are nucleon and pion velocities. (auth)

28788 WHAT CAN BE LEARNED FROM INCLUSIVE ANTIPROTON SPECTRA. Jengo, R.; Krzywicki, A.; Petersson, B. (Laboratoire de Physique Theorique et Particules Elementaires, Orsay, France). Phys. Lett. 43B: No. 5, 397-400(5 Mar 1973).

Without free parameters, we explain the rise with energy of the $\bar{p}$ yield and we obtain a correct description of $\bar{p}$ rapidity distributions at ISR energies. We show that $\bar{N}$ and N have the tendency to be created within a small rapidity interval as expected, e.g., from the multiperipheral model. (auth)

28789 Σ PRODUCTION DATA AND THE ABSORPTION PATTERN IN TWO BODY SCATTERING. Chiu, C. B. (Brookhaven National Lab., Upton, NY); Ugaz, E. Phys. Lett.; 43B: No. 4, 327-332(19 Feb 1973).

Amplitudes for the Σ production are analyzed. These amplitudes together with other scattering data suggest the following "absorption pattern"; a strong suppression in the central waves for the planar duality diagram case, and no such suppression in the nonplanar case. (auth)

28790 SUM RULES FOR THE STRUCTURE PARAMETERS OF THE NUCLEON. Matsuda, S. (CERN, Geneva). Phys. Lett.; 43B: No. 4, 292-298(19 Feb 1973).

Based on the parton model and some commonly used assumptions, a class of sum rules is obtained which relates the structure parameters of the nucleon such as the proton charge radius with the quantities which can be most directly connected with the experimental observables in the hard massive photon limit, that is, the deep inelastic nucleon structure functions. (auth)

28791 STATISTICAL METHOD FOR TESTING OF ANALYTICITY AND ITS APPLICATION. Lichard, P. (Technical Univ., Bratislava). Acta Phys. Austr., Suppl.; No. 9, 867-869(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

A new method is proposed for testing the analyticity properties. Instead of using dispersion relations with traditional uncertainties in estimating the errors of principal value integrals, a suitably defined set of moments is used. As examples the pion-nucleon charge exchange forward amplitude and the pion-nucleon coupling constant are discussed. (JFP)

28792 INVESTIGATION OF THE HIGH-ENERGY BEHAVIOR OF THE MESON-NUCLEON SCATTERING AMPLITUDE IN SCALAR MODEL BY MEANS OF THE FUNCTIONAL METHOD. Barashov, B. M.; Nesterenko, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 14: No. 1, 27-35 (Jan 1973). (In Russian).

The high energy meson-nucleon scattering amplitude is investigated in the scalar model $L_{int} = g\psi^2\varphi$ by means of the functional method. The sum of the infinite class of diagrams in which the meson interacts with the nucleon turning into a virtual nucleon-antinucleon pair can be presented in a modified eikonal form. (auth)

28793 PHYSICS OF THE Q-REGION OF $K\pi\pi$ MASS. Bowler, M. G. (Oxford Univ.). pp 149-167 of Meson Resonances and Related Electromagnetic Phenomena. Dalitz, R. H. (ed.). Bologna; Editrice Compositori (1972).

From international conference on meson resonances and related electromagnetic phenomena; Bologna, Italy (14 Apr 1971). See CONF-710421-.

An introductory review is given of experimental studies of the Q-region enhancement in the $K\pi\pi$ mass spectrum from $K^\pm p \to (K\pi\pi)^\pm p$ interactions. The facts that are well established about

the Q and the problems yet to be solved are summarized. The implications of a two resonance interpretation are discussed. (LBS)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 28652, 28916, and 29205.

28794 (CNRS-CPT-72-P-485) COMMENTS ON SPIN EFFECTS IN PROTON-PROTON CROSS SECTION MEASUREMENTS. Soffer, J.: Wray, D. (Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique). Oct 1972. 8p. Dep. NTIS (U. S. Sales Only) $3.00.

The upper limit of the proton-proton total cross section may be estimated at ISR energies using the optical theorem. In fact, the total cross section is equal to the value derived from the forward imaginary part of the elastic scattering only when there is no spin dependence. It is shown that the importance of the spin dependence can be obtained from the positivity. (France)

28795 THREE-NUCLEON PROBLEM AT HIGH ENERGY: ENERGY DEPENDENCE OF BACKWARD p-d ELASTIC SCATTERING BELOW 1 GeV. Bouchez, R.; Jungerman, J. (Univ., Grenoble, France). J. Phys. (Paris), Colloq.; No. 5, 128(1972).

The energy dependence of the momentum-transfer singularities in p-d scattering was studied. The singularity related to the backward peak observed for an incident energy of 500 MeV was explained either by introducing the N(1688) baryon resonance in the d ground state or by current-exchange processes involving the three nucleons. (FR)

28796 WEAK INTERACTION EFFECTS IN INCLUSIVE REACTIONS AT HIGH ENERGIES. Nikolaev, N. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 17: No. 1, 119-125(Jan 1973). (In Russian).

P-odd polarizations of hyperons in $p + N \rightarrow Y + X$ inclusive reactions arising due to interference of strong and weak interactions is discussed. In the framework of vector dominance model their magnitude is connected with the amplitude of $p + N \rightarrow N + Y + K^*$ (890) reaction in the multiregge pole domain. It is shown, that investigation of Σ^+-hyperon production would make it possible to get information on the presence of neutral hadron current in the Hamiltonian of weak interactions. (auth)

28797 INELASTIC SUM RULE FOR HIGH-ENERGY HADRON SCATTERING AND NUCLEON-NUCLEON CORRELATIONS. Bleszynska, E. (Jagellonian Univ., Krakow); Bleszynski, M.; Malecki, A.; Picchi, P. Phys. Lett., B; 43B: No. 5, 355-358 (5 Mar 1973).

We have considered the influence of short-range dynamical and statistical correlations on the elastic and summed inelastic scattering of high-energy hadrons from light nuclei. Our calculations are based on the complete multiple scattering series of Glauber. The correlation effects are discussed on the example of the inelastic sum rule for p-^{16}O scattering. (auth)

28798 RESULTS OF THREE-NUCLEON CALCULATIONS. Alt, E. O. (Univ., Mainz). Acta Phys. Austr., Suppl.; No. 9, 139-178(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The three-nucleon system is discussed in which the interaction is assumed to consist of a sum of pure two-body potentials. Genuine three-body forces are neglected. The reliability of the various approximation methods and the present status and prospects of restricting the number of admissable nucleon-nucleon potentials are considered. (JFP)

28799 EIKONAL APPROXIMATION IN THE 3-BODY SYSTEM. Namyslowski, J. M. (Univ., Warsaw). Acta Phys. Austr., Suppl.; No. 9, 184-194(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The 2- and 3-body eikonal approximations are summarized, and an explicit formula for the 3-body eikonal scattering T-matrix, describing $\pi d \rightarrow \pi d$ process, is given. A relation between Glauber formula, Faddeev equation, and Watson multiple scattering series is considered, and a number of cancellations off- and on-shell are shown. As an application the deuteron recoil form factor is presented and calculated for different values of momentum transfer. (auth)

28800 NEW REPRESENTATION OF PROTON-PROTON AMPLITUDES, RESONANT SCATTERING FROM COMPLEX, ENERGY-DEPENDENT SQUARE WELL, AND PARTIAL WAVE EXPANSION OF REGGE AMPLITUDES. Cheng, T. Y. Bloomington, IN; Indiana Univ. (1972). 114p. University Microfilms Order No. 73-2699.

Thesis (Ph.D.).

This work is divided into three parts, each of which treats a different aspect of high-energy scattering. Two different descriptions of high-energy scattering have been discussed frequently in the literature: a direct-channel description and a cross-channel description. In Part 1, a representation for the proton-proton scattering amplitude which is different from the usual direct-channel and cross-channel representations is considered, obtaining good agreement with the data. Other models of proton-proton scattering, including both the direct-channel and cross-channel descriptions, are also discussed for comparison. In Part 2, the resonances occurring in scattering by a complex square-well potential which is also energy-dependent are discussed. This problem is treated because resonances are an important feature of elementary particle scattering, and an attempt is made to see the pattern of such resonances in a soluble model. In Part 3, an analytical way of obtaining a partial wave analysis of a cross-channel Regge description of scattering is given. Such a partial wave decomposition is useful in comparing the cross-channel description with a direct-channel model. (Diss. Abstr. Int., B)

28801 MULTIPLE PION PRODUCTION IN HADRON COLLISIONS IN THE FRAMEWORK OF MAGNETIC CHARGE MODEL OF HADRONS AND MULTIPERIPHERALISM. Duru, I. H. Boulder, CO; Univ. of Colorado (1972). 92p. University Microfilms Order No. 73-1763.

Thesis (Ph. D.).

The production of n-neutral pions in very high energy proton-proton collisions is studied as an application of the magnetic charge model of strong interactions. Neutral pions are considered to be the bound states of dyon-antidyon pairs. Throughout the calculations the multiperipheral model and the infinite momentum kinematical frame are used. For the production cross section of n-neutral pions the energy dependence of the form $\sigma(n) \sim (\ln s)^n/S^2$ was obtained. For the multiplicity distribution the Poisson distribution was obtained, and the average multiplicity of the produced neutral pions was found to be $\langle n \rangle \sim c_0 \ln s$. With some simplifying assumptions the parameter c_0 was calculated and the value $c_0 \sim 0.02$ was found with an estimated dyon mass of $\mu \sim 10$ GeV. Further improvements of the model are also discussed briefly. (Diss. Abstr. Int., B)

28802 VACUUM POLARIZATION EFFECTS IN S WAVE PROTON-PROTON DIFFUSION. Naisse, J. P. (Univ., Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 58: No. 7, 872-893 (1972). (In French).

The relatively complex calculation of all the magnitudes occuring in the analysis of vacuum polarization effects in s-wave proton-proton scattering at low energies is reduced, by the construction of very simple analytic representations, to the calculation of magnitudes corresponding to the absence of the whole vacuum polarization effect. (JFP)

28803 INTERACTION OF PARTICLES AND NUCLEI OF HIGH AND SUPERHIGH ENERGIES WITH NUCLEI. Barashenkov, V. S.; Il'inov, A. S.; Sobolevskii, N. M.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna, USSR). Usp. Fiz. Nauk; 109: No. 1, 91-136(Jan 1973). (In Russian).

Various aspects of inner nuclear cascades and the application of the Monte-Carlo method to their calculation is discussed, and a nuclear model and calculations of particle collisions with inner-nuclear nucleons are examined. The angular distributions of particles produced in reactions such as $\pi^- + p \rightarrow N + n\pi$ are graphically depicted. A general scheme for inner-nuclear cascades is offered, facilitating the determination of πN- and NN-interactions by algorithm. The cascade model is compared with experimental results through considerations of energy spectra of protons and neutrons from various nuclei, angular distributions of nucleons formed by 660 MeV proton-nucleus interactions, and the energy spectra of α-particles emitted from ^{12}C interactions with 660 MeV protons. A model is offered for inner-nuclear cascades in the several-GeV region, and the theory of inelastic collisions of two nuclei is explored. 85 references. (KSW)

28804 INTERACTIONS OF HIGH-ENERGY PARTICLES WITH DEUTERONS. Kolybasov, V. M.; Marinov, M. S. (Inst. of Theoretical and Experimental Physics, Moscow). Usp. Fiz. Nauk; 109: No. 1, 137-156(Jan 1973). (In Russian).

Total cross sections of particle-deuteron interactions are defined as: $\sigma_d = \sigma_p + \sigma_n - \Delta$, where Δ is the "cross section defect"; the Glauber correction, and the determination of Δ by

π-meson or nucleon scattering are discussed. The deuteron form factor, angular distributions of elastic pd- and πd-scattering, inelastic scattering by deuterons, and inelastic shielding and topics of individual treatment are covered in this review. 53 references (many being multiple citations). (KSW)

Particle Invariance Principles and Symmetries

General

Refer also to abstracts 28575, 29158, 29183, 29238, and 29427.

28805 BREAKING OF ASYMPTOTIC SU(3) AND PRODUCED PARTICLE RATIOS. Rotelli, P. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Lett.; 43B: No. 4, 299-300(19 Feb 1973).

A model for the breaking of asymptotic SU(3) (applied to multiparticle processes) analogous to that for the mass operator is presented and its consequences for particle ratios discussed. (auth)

28806 SU(3) IN AN O(3) BASIS. II. SOLUTION OF THE STATE LABELLING PROBLEM. Hughes, J. W. B. (Queen Mary Coll., London). J. Phys., A (London); 6: No. 3, 281-298 (Mar 1973).

The problem of 1 degeneracies in the reduction of irreducible representations (p,q) of SU(3) with respect to its O(3) subgroup is considered. Orthonormal states corresponding to the same 1 value are defined as eigenvectors of hermitian operators and, by the use of 1 shift operators, an algorithm is given for the calculation of the eigenvalues of these hermitian operators. A full analysis is given of the (p,0) representations, which contain no 1 degeneracies, and all eigenvalues of the third and fourth order O(3) scalar operators are calculated for the (4,2), (5,2) and (6,2) representations which contain doubly 1 degenerate states. (auth)

28807 COBOUNDARY DEFORMATIONS OF LIE ALGEBRA AND THE RELATIVIZATION OF INTERNAL SYMMETRY. Liakhovski, V. D. (Institut Henri Poincare, Paris). Ann. Inst. Henri Poincare, Sect. A; 17: No. 2, 119-129(1972). (In French).

It is shown that the utilization of coboundary functions leads to new deformations of real Lie algebra. The fundamental properties of these deformations are studied. Applications of these deformations to the relativization of internal symmetry are also examined. (France)

28808 SYMMETRY BREAKING AND SIGMA COMMUTATORS. Oakes, R. J. (Northwestern Univ., Evanston, IL). Acta Phys. Austr., Suppl.; No. 9, 518-532(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

In the context of broken chiral symmetry the sigma commutators, the evaluation of their matrix elements and the significance of the resulting magnitudes are discussed. (auth)

28809 SYMMETRY AND GROUP THEORY: INTRODUCTORY REMARKS. Sahni, V. C. (Bhabha Atomic Research Centre, Bombay). pp 19-31 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

28810 SYMMETRY IN PARTICLE PHYSICS. Mukunda, N. (Tata Inst. of Fundamental Research, Bombay). pp 57-64 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

28811 SU(6) AND CHIRAL SU(3) SYMMETRY BREAKING. Delbourgo, R. (Imperial Coll. of Science and Tech., London). J. Phys., A (London); 6: No. 3, 409-414(Mar 1973).

SU(6) breaking is used to obtain the form of chiral SU(3) breaking. A very specific mixture of $(3,\bar{3})^{1+8}$, $(6,\bar{6})^{1}$ and $(8,8)^{1}$ chiral representations is predicted. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 28752, 28842, and 29235.

28812 U(3) NONET SCHEME FOR LEPTONS. Salam, A. (Imperial Coll. of Science and Tech., London); Pati, J. C. Phys. Lett.; 43B: No. 4, 311-313(19 Feb 1973).

Introducing six new heavy leptons, we construct a U(3) scheme for leptons. The leptonic U(3) is exactly parallel to the hadronic U(3). One may also introduce quark-like leptonic triplets. A "natural" value of 60° emerges for the mixing angle with m_w = 53 GeV in a theory of weak and electromagnetic interaction based on this U(3) symmetry. There are no neutral $\Delta S_1 = 0$ neutrino currents. (auth)

28813 DIRAC'S EQUATION AND A NEW GROUP OF EXTERNAL SYMMETRY. Mendels, E.; Wouthuysen, S. A. (Univ., Amsterdam). Phys. Lett.; 43B: No. 4, 333-337(19 Feb 1973).

It is shown how the handedness of the massless leptons, and the Poincaré invariance of leptonic interactions, can be based on a new group of external symmetry. (auth)

Applications (Strong)

Refer also to abstract 28783.

28814 MODEL OF CHIRAL SYMMETRY BREAKING FOR $0^{\pm}$ MESONS. Khelashvili, A. A. (Tbilisi State Univ., USSR). Teor. Mat. Fiz.; 14: No. 3, 314-324(Mar 1973). (In Russian).

The mass formulas for $0^{\pm}$ mesons are obtained in the framework of the SU(3) σ-model by means of the small oscillation method. General properties of the spectrum are discussed from the viewpoint of symmetry of the vacuum and symmetry of the Lagrangian. The expressions for divergencies of vector and axial currents are also obtained, and the example of the realization of the SU(3) and SU(3) ⊗ SU(3) symmetries is considered on the basis of solving the condition of stability of the vacuum. (auth)

28815 QUARK MODELS AS REPRESENTATIONS OF CURRENT ALGEBRA. Young, K. Pasadena, CA; California Inst. of Tech. (1972). 72p. University Microfilms Order No. 72-30,843.

Thesis (Ph. D.).

The equal time U(12) algebra of scalar, pseudo-scalar, vector, axial and tensor currents abstracted from Lagrangian quark field theory is studied. The attempt is made to represent the "good" part of this algebra at infinite momentum on nonexotic states, i.e., on hadron states of conventional nonrelativistic quark models. Relativistic constraints embodied in the angular condition must also be met. Previous work has shown that the unintegrated algebra cannot be represented on nonexotic states. In this study, the much less restrictive problem of the once and twice integrated algebra is considered. It is found that even the twice integrated algebra cannot be satisfied within nonexotics. This strongly suggests that exotics are an essential part of the hadron spectrum. (Diss. Abstr. Int., B)

28816 COMPLETE LADDER CLASS AND RELATIVISTIC GENERALIZATIONS. Nikolov, A. V. (Univ., Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 11, 1471-1474(1972). (In Russian).

A physically complete set in ladder U(6,6)-symmetry had previously been introduced by the author in 1971. This led to a unified scheme of hadron classification (in a system at rest), and the question arose as to the outcome in the case of relativistic generalizations. This question was investigated with the aid of the nonhomogeneous group U(6,6), i.e., the half-line product U(6,6) · T(143), the starting point being Dirac and Gell-Mann matrices. (KSW)

28817 HADRON STATES IN THE SCHEME OF THE LADDER U(6,6) SYMMETRY. Vaklev, I. S.; Drenska, S. B.; Ivanov, M. I.; Nikolov, A. V. (Univ., Sofia). Teor. Mat. Fiz.; 14: No. 1, 56-69(Jan 1973). (In Russian).

The ladder representations of the group U(6,6) are used for classification of hadrons. On the basis of some general rule the physical part of the meson and baryon ladder space is separated. The vectors corresponding to the meson and baryon states are obtained. To this end the complete set of commuting self-adjoint operators is used, which includes the hypercharge, baryon number, squares of the spin and isospin and their third projections, and so on. The results are collected in two classification tables. (auth)

Field Theories

General

Refer also to abstract 28583.

28818 PROPER OSCILLATIONS OF CLASSICAL CHIRAL FIELD. Andreev, I. V. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 17: No. 1, 186-189(Jan 1973). (In Russian).

Solutions for the system of equations for classical chiral field, dependent on one space-time variable were found. Application of these equations in describing some pion multiple production processes is discussed. (auth)

28819 QUANTUM MECHANICS OF THE INTERACTION OF GRAVITY WITH ELECTRONS: THEORY OF A SPIN-TWO FIELD COUPLED TO ENERGY. Huggins, E. R. Pasadena, CA; California Inst. of Tech. (1962). 229p. University Microfilms Order No. 73-4653.

Thesis (Ph. D.).

Two methods of finding the energy tensor from the Lagrangian of a system are those of Belinfante, and Landau and Lifschitz. Neither of these methods are unique; two energy tensors for the same system differ by a term that is symmetric, has zero divergence, and is itself a second derivative. It is shown that such a term in the energy tensor produces physical effects that in one case can be measured experimentally. It is because of this lack of uniqueness of energy tensors that it is not sufficient to consider gravity merely as a spin-two field coupled to energy. To set up the quantum mechanics of gravity interacting with electrons, the curved space Lagrangian for the Dirac field is expanded in terms of the gravitational fields $h_{\mu\nu}$. It is checked that the expanded Lagrangian has the same transformation properties as the original curved space Lagrangian. The calculations presented are the gravitational Rutherford scattering of electrons, emission of low energy gravitons by electrons, the scattering of gravitons by electrons, the gravitational self-energy of the electron, and the most divergent part of the vacuum polarization calculation. There is also an investigation of the effects of the spin of the electron by comparison with a spin-zero particle interacting with gravity. (Diss. Abstr. Int., B)

Quantum Field Theory

Refer also to abstracts 29052 and 29429.

28820 (CNRS-CPT-72-P-489) CAUSAL GHOST-FREE COVARIANT HARMONIC OSCILLATOR MODEL FOR BOSONS RESPECTING CPT AND ALL THAT. Bacry, H.; Chang, N. P. (Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Theorique). Nov 1972. 7p. Dep. NTIS (U. S. Sales Only) $3.00.

The quantization of a new infinite component wave equation is discussed. The quantized field satisfies the microcausality relations and has momentum support with a $(mass)^2$ spectrum equal to that of a ghostless relativistic harmonic oscillator. This model does not violate the spin statistical theorem and is CPT invariant. The field transforms in accordance with an infinitely reducible representation of SL(2,C). (France)

28821 (CONF-720582-, pp 69-83) Q.E.D. PROBLEMS (THEORETICAL). Lautrup, B. (CERN, Geneva). 1972.

From Informal meeting on electromagnetic interactions; Frascati, Italy (2 May 1972).

A review is given of recent developments in the low energy region of quantum electrodynamics. The Lamb shift, hydrogen fine structure, the hyperfine structure of hydrogen, muonium, and positronium, muonic atoms, lepton aromalous magnetic moments and two photon processes are covered. (JFP)

28822 EQUIVALENCE THEOREM AND GAUGE INVARIANCE IN RENORMALIZED THEORIES. Kallosh, R. E.; Tyutin, I. V. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 17: No. 1, 190-209(Jan 1973). (In Russian).

A formal proof of equivalence theorem is presented revealing its sense more precisely: renormalized theories are equivalent. The same scheme is applied in proving gauge invariance of renormalized gauge theories, admitting gauge-invariant regularization; Yang-Mills massless field and Yang-Mills field with spontaneous violation of symmetry. Dependence of Green functions and renormalization constants on gauge conditions is being studied in these models. Independence of physical masses, renormalization constants and physically renormalized S-matrix from the choice of gauge is proved. (auth)

28823 SYSTEM OF EQUATIONS FOR VERTEX FUNCTIONS OF THE T-EXPONENT. Shcherbina, V. A. (Physical-Technical Inst. of Low Temperatures, Kharkov). Teor. Mat. Fiz.; 14: No. 3, 342-356(Mar 1973). (In Russian).

The operator-valued functional depending on the cut-off parameters and turning into the renormalized perturbation series for the S-matrix of the scalar field with couplings $\lambda : \varphi^3$: and $\lambda : \varphi^4$: after the formal taking a certain limit is constructed. The characteristic equation for this functional is obtained. It permits one to construct the set of the ultraviolet divergence-free equations for the vertex functions Σ_n, which represent the sums of contributions of strongly connected Feynman diagrams. (auth)

28824 FIELD-THEORETICAL SPACE-TIME OPERATORS. Papp, E. Stud. Univ. Babes-Bolyai, Ser. Phys.; 17: No. 2, 23-31 (1972).

The space operator $\vec{X}$ (t) is defined as the field-theoretic counterpart of the $\vec{x}$ position-vector. Passing to a well-defined value of the angular-momentum, the radial space operator R(t) and also the time operator T(t) are also defined as field-theoretic counterparts of $|\vec{X}|$ and $|\vec{X}|/U$, respectively. Taking into consideration the p-momentum representation of a free Klein-Gordon field, it is proved that the above calculations lead to meaningful operatorial expressions only at large |t|-values. Performing the average values of the operators R(t) and T(t) with respect to the general one-particle state of the Klein-Gordon field, the usual expressions of the quantum mechanical space-time averages result. The collision-time and proper-time operators are also defined. (LBS)

28825 CROSSING SYMMETRIC BETHE-SALPETER EQUATION. Yaes, R. J. (Univ., Mainz). Acta Phys. Austr., Suppl.; No. 9, 179-183(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

It is shown that the four-point function in relativistic field theory satisfies the crossing symmetric Bethe-Salpeter equation. (JFP)

28826 FUNCTIONAL RELATIVISTIC CLUSTER THEORY. Stumpf, H. (Univ., Tuebingen, Ger.). Acta Phys. Austr., Suppl.; No. 9, 195-255(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

A theory of observables with respect to relativistic clusters in spinor field theory is formulated using functional quantum theory of relativistic cluster representations. (JFP)

28827 ANOMALOUS WARD IDENTITIES. Wess, J. (Univ., Karlsruhe, Ger.). Acta Phys. Austr., Suppl.; No. 9, 494-517(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

In these lectures it is shown that the modifications or anomalies which arise in the divergence of currents lead to many observable effects. Current anomalies in a simple model and anomalous Ward identities and their consequences are discussed, and a comparison with experiment is made. (JFP)

28828 SO_4-INVARIANT SOLUTIONS OF THE $\lambda\phi^4$ THEORY. Castell, L. (Max-Planck-Institut zur Erforschung, Starnberg, Ger.). Acta Phys. Austr., Suppl.; No. 9, 847-850(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

The SO(4) invariant solutions of the classical $\lambda\phi^4$ field equations are found. (JFP)

28829 ULTRALOCAL MODEL: FIELDS WITHOUT PARTNERS. Hegerfeldt, G. C. (Univ., Goettingen, Ger.); Klauder, J. R. Acta Phys. Austr., Suppl.; No. 9, 856-859(1972)

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

It is shown in quantum field theory that although the ultralocal model seems to fulfill all necessary conditions for a conjugate field, such a partner field does not exist as a well defined operator. (JFP)

28830 SKEW-SYMMETRIC TENSOR-SPINOR FORMULATION OF THE SPIN $\frac{3}{2}$ FIELD. Fisk, C.; Tait, W. (Institut Henri Poincare, Paris). J. Phys., A (London); 6: No. 3, 383-392(Mar 1973).

The formulation of a field theory for a spin $\frac{3}{2}$ particle is sought in terms of a skew-symmetric tensor-spinor. If the wave function transforms irreducibly under the rotation group, the Lagrangian density is not hermitian, but if it transforms as the direct sum of two spin $\frac{3}{2}$ components, this defect is removed. Furthermore, when minimal coupling to the electromagnetic field is introduced in the latter case, propagation remains causal, so that some improvement over the usual vector-spinor theory is achieved. (auth)

28831 COMPARISON OF 2e/h DETERMINATIONS AT NSL USING POINT-CONTACT AND THIN-FILM JOSEPHSON JUNCTIONS. Harvey, I. K.; MacFarlane, J. C.; Frenkel, R. B. (National Standards Lab., Sydney). pp 387-392 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

An interim report is given on comparative measurements of 2e/h which have been carried out at NSL using point-contact and thin-film junctions in otherwise identical experimental arrangements. Results show that the standard deviations of the respective means are of the order of 0.05 ppm. It is concluded that the means are identical to within 0.07 ppm and that there is no significant difference at the present level of precision between point-contact and thin-film determinations of 2e/h. Greater precision will need better junction fabrication techniques, more effective electromagnetic screening and improvements in stability of the NSL standard of emf. (UK)

28832 RECENT RESULTS OF THE e/h-MEASUREMENT AT PTB. Kose, V.; Melchart, F.; Fack, H.; Gutmann, P. (Physikalisch-Technische Bundesanstalt, Brunswick). pp 393-397 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The methods and techniques used to measure e/h in a series of experiments at PTB are described. Point contacts were used throughout. Precautions taken against inaccuracies caused by thermal emf drift, frequency drift, resistor stability, and change in zero reference of the Josephson zero-voltage characteristic are reported. It is stated that the overall accuracy of the measurements was between 1.4 and 1.8 parts in 10^7 depending on the final random error of the 2e/h values. (UK)

28833 RECENT NPL WORK ON e/h. Gallop, J. C.; Petley, B. W. (National Physical Lab., Teddington, Eng.). pp 398-402 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Measurements of 2e/h using the ac Josephson effect have been made at the NPL over a three-year period with increasing precision. The measurement essentially consists of measuring a microwave frequency and comparing as accurately as possible two voltages which differ by two or more orders of magnitude. The method used and techniques employed to ensure accuracy are given. The results are reported, and it is estimated that the overall uncertainty has been reduced to a point where the experiment may be regarded as a means of monitoring variations in the national maintained voltage standard. (UK)

28834 MEASUREMENTS OF 2e/h VIA THE AC JOSEPHSON EFFECT. Finnegan, T. F.; Witt, T. J.; Field, B. F.; Toots, J. (National Bureau of Standards, Washington, DC). pp 403-410 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A comparison of the reported sub-ppM 2e/h determinations based on measurements made in 1970 in five laboratories is tabulated. A series of 2e/h measurements has now been made at the site of the NBS unit of voltage with the same low-voltage-comparison instruments as used in the sub-ppm measurements at the University of Pennsylvania. Precautions taken to obtain accurate determinations are outlined. The principal sources of uncertainty are discussed. The final value of 2e/h is reported at 483.593 589 ± 0.000 024 THz/V_{NBS-69}. (UK)

28835 METHOD TO SOLVE THE DIRAC EQUATIONS. Mel'nichenko, I. P.; Pik, E. M. (Inst. of Mathematics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 10, 887-890(Oct 1972). (In Ukrainian).

By means of hypercomplex functions and the Hadamard method the system of the Dirac equations is solved for the case when the components of the wave function are presented on some sufficiently smooth four-dimensional hypersurface. (auth)

28836 RENORMALIZED SCATTERING THEORY FOR THE YUKAWA MODEL. I. Construction of Dressing Transformation. Aref'eva, I. Ya. (Inst. of Mathematics, Leningrad). Teor. Mat. Fiz.; 14: No. 1, 3-17(Jan 1973). (In Russian).

The convergence of perturbation series for dressing transformation needed in construction of the renormalized wave operators in the Yukawa model with space and ultraviolet cutoffs is proved. (auth)

28837 SINGLE-TIME EQUATION FOR THE SYSTEM OF THE SCALAR AND SPINOR PARTICLES IN QUANTUM FIELD THEORY. Belov, V. K. (Moscow State Univ.). Teor. Mat. Fiz.; 14: No. 1, 45-55(Jan 1973). (In Russian).

Quasipotential equation and generalized equation of the Sokolov-Heitler quantum theory of damping are obtained in a covariant way from the single-time formulation of the Bethe-Salpeter equation for the system of the scalar and spinor particles. Analysis of the spin structure of these equations is performed and it is demonstrated how the equation of the quantum theory of damping can be reduced to algebraic equations for partial amplitudes. (auth)

Gravitation and General Relativity

28838 SYMMETRIC FIELD EQUATIONS AND EQUATIONS OF MOTION IN A PSEUDO-RIEMANNIAN VARIETY WITH A NON-SYMMETRIC CONNECTION. Clerc, R. L. (Univ., Toulouse). Ann. Inst. Henri Poincare, Sect. A; 17: No. 3, 227-257(1972). (In French).

Space-time is assimilated to a pseudo-riemannian variety with a nonsymmetric connection immersed in an 8-dimensional variety. The presence of a torsional tensor and a tensor due to the immersion of V_4 in V_8 is noted. A variational principle leading to symmetric equations is stated. A Lagrangian geometry (which generalize the R of the external Einstein case) is used. (France)

28839 POSITION-DEPENDENT ROBERTSON-WALKER SOLUTIONS OF THE BRANS-DICKE FIELD EQUATIONS. McIntosh, C. B. G. (Monash Univ., Clayton, Australia). Phys. Lett.; 43A: No. 1, 33-34(12 Feb 1973).

Cosmological solutions of the Brans-Dicke gravitational field equations are given in which the metric is the flat Robertson-Walker one and in which the scalar field, energy density, and pressure are functions of position as well as time. (auth)

28840 ZERO-MASS SCALAR AND ELECTROSTATIC FIELDS WITH CENTRAL SYMMETRY IN GENERAL RELATIVITY. Uhlir, M. (Technical Univ., Prague); Dittrich, J. Czech. J. Phys.; 23: No. 1, 1-9(1973).

All asymptotically flat space solutions of Einstein equations with energy-momentum tensor of electrostatic and zero-mass scalar static central symmetric fields as a source were found. There are five branches of general solution; only two of them are contained in previous Penney's solution. In a limit of pure electrostatic field and pure scalar field our solutions become identical with corresponding solutions known previously. (auth)

28841 GRAVITATIONAL CONSTANT G. Lowry, R. A.; Towler, W. R.; Parker, H. M.; Kuhltau, A. R.; Beams, J. W. (Univ. of Virginia, Charlottesville). pp 521-528 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Possible methods of measurement of G are reviewed. A new method possessing novel features which contribute to the potential for improved accuracy is described. The method employs two large tungsten spheres mounted on a rotary table and a small horizontal copper cylinder (the small mass system) suspended in an airtight chamber mounted on the same table. Although the method shows possibilities of measuring very small forces (torques) with high sensitivity, there are known difficulties associated with the method due to the effect of a gas in a small mass system chamber, the effect of magnetic fields, temperature stability and vibrations. (UK)

28842 FIVE-DIMENSIONAL THEORIES AND CP-VIOLATION. Thirring, W. (Univ., Vienna). Acta Phys. Austr., Suppl.; No. 9, 256-271(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

Five-dimensional theories of gravitation and electricity are reviewed, and it is studied why they endow spin-½ particles with an electric dipole moment. It is found to be too small to explain the $K_L \to 2\pi$ decay. It is speculated that one might obtain an attractive origin of the observed CP violation if also strong interactions are included in this unification. (auth)

28843 GRAVITY PROBLEMS AND PARTICLE PHYSICS. Lucey, C. A. Providence; Brown Univ. (1971). 95p. University Microfilms Order No. 73-2312.

Thesis (Ph.D.).

Problems relating gravity to particle physics in either of two ways are considered. First, problems which arise out of cos-

mology and are therefore called "global" in nature are considered. The effects of a possibly degenerate sea of neutrinos upon lepton masses, quantum electrodynamics rules, or stellar events all fall within the global classification of gravitational problems. The second classification of problems is one which is called "local." Here the manner in which graviton terms may alter the nature in which massive elementary particles interact with one another is considered. (Diss. Abstr. Int., B)

28844 SPINOR PARTICLES IN CURVED SPACES. Harkins, M. D. Buffalo; State Univ. of New York (1972). 129p. University Microfilms Order No. 73-5119.

Thesis (Ph.D.).

In this investigation some of the implications of the quaternion formulation of general relativity are examined in terms of the scattering of spinor particles in curved spaces. A number of solutions to the quaternion field equations of general relativity are constructed and it is found that these correspond to solutions of the Einstein field equations for the cases of spherical and cylindrical symmetry. Using these solutions and the generally covariant Weyl equations, the elastic scattering of neutrinos in a curved space is considered. A suitable scattering formalism is obtained by assuming first order expansions for the quaternions and this is used for obtaining differential cross sections with the first Born approximation. These cross sections could be useful in obtaining the matter distribution in nuclear material in terms of scattering of high energy neutrino beams. Finally the four-component spinor formulation of general relativity is considered, and compared to the quaternion formalism. It is found that for the case of a Schwarzschild metric, the generalized Dirac field and the resulting interaction correspond to those previously obtained using quaternions. The scattering cross section for a zero mass particle, using an expansion of the Dirac fields and the first Born approximation is obtained. This cross section is identical to the one found from the two-component formalism. (Diss. Abstr. Int., B)

Scattering Theory

Refer also to abstracts 28800 and 28836.

28845 OPERATOR METHOD OF SOLVING THE QUASIPOTENTIAL EQUATIONS AND A CONCEPTION OF STRAIGHT-LINE PATHS AT HIGH ENERGY. Kuleshov, S. P.; Matveev, V. A.; Sisakyan, A. N.; Smondyrev, M. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 14: No. 3, 325-331(Mar 1973). (In Russian).

The operator method of solving the quasipotential equations is developed. It is shown that in high energy limit this method just as the well known straight-line path approximation in the framework of functional integration methods is a realization of the general conception of straight-line paths. (auth)

28846 SOLUTION OF THE QUASIPOTENTIAL EQUATION IN THE FORM OF THE FEYNMAN CONTINUAL INTEGRAL. Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 14: No. 3, 332-341(Mar 1973). (In Russian).

The solution of the quasipotential equation is obtained in the form of the Feynman continual integral over the phase-space paths, for which a method of finite approximation is suggested. By the continual integration method the high energy asymptotics of the quasipotential scattering amplitude is investigated. (auth)

28847 TOWARDS A DYNAMICAL INTERPRETATION OF DUAL AMPLITUDES WITH MANDELSTAM ANALYTICITY. Schmidt, M. G. (Stanford Univ., CA). Phys. Lett.; 43B: No. 5, 417-421 (5 Mar 1973).

The infinite momentum frame loop variable x should be identified with the variable appearing in the integral representation of dual amplitudes with Mandelstam analyticity. Large angle and Regge behavior is discussed under this aspect. (auth)

28848 THREE-BODY PROBLEM. Sandhas, W. (Univ., Mainz). Acta Phys. Austr., Suppl.; No. 9, 57-138(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972).

See CONF-720224-.

In this lecture the general problems of composite particle processes in the framework of the three-body theory are shown. Also an exact reduction scheme is developed which gives effective two-particle equations. (JFP)

28849 REPRESENTATION OF PARTIAL AMPLITUDES BY POWER MOMENTS AND ITS CONSEQUENCES. II. Yaśun, V. A. (Inst. of Theoretical Physics, Kiev). Teor. Mat. Fiz.; 14: No. 1, 36-44(Jan 1973). (In Russian).

Constraints on the partial amplitudes satisfying the Froissart-Gribov representation are obtained. These constraints represent the estimates for the determinants composed of the partial amplitudes. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

28850 STRONGLY ATTENUATED SYMMETRICAL WAVES IN SUPERFLUID HELIUM. Wehrum, R. P.; Meinhold-Heerlein, L. (Univ., Mainz). Phys. Lett.; 43A: No. 4, 391-392(26 Mar 1973).

The existence of a series of strongly damped symmetrical wave propagating in a He-II layer of arbitrary width is proven and some of their properties (phase velocities, attenuation coefficients) are calculated. (auth)

Superconductivity

Refer also to abstract 28408.

28851 (CONF-720908–, pp 3-7) PROLONGED ADOLESCENCE OF SUPERCONDUCTIVITY. Kolm, H. H. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The application of superconductivity to purposes affecting everyday life has been retarded by pursuing only the development of materials while ignoring the problems associated with their practical use. The most important potential applications are in medicine, metallurgy, mining, pollution abatement, power generation and transportation. (auth)

28852 (CONF-720908–, pp 529-536) MAGNETIC INSTABILITY AND TRANSIENTLY STABILIZED MAXIMUM CURRENT OF V_3Ga TAPE COILS. Noguchi, T. (ULVAC Corp., Chiba, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A small coil made from superconducting V_3Ga tape is located in a superconducting solenoid so that their central axes cross at right angle. Various coils which differ in cooling conditions, thickness of stabilizing copper foils and width of the tape are tested in a preset current-increasing field. For a preset current which is smaller than a threshold value, coils do not go normal even if large flux jumps are observed. But for a current over the threshold value, a first flux jump makes the coil normal. The threshold current depends on the tape width, cooling conditions and the thickness of stabilizing copper. This threshold current is considered to be a transiently stabilized maximum current which is expressed by $I/I_c < phS(Tc-Tb)/\rho I_c^2$. It is found that the threshold current is very close to the quenching current of a larger V_3Ga tape coil. (auth)

28853 (CONF-720908–, pp 537-538) PRELIMINARY MEASUREMENTS OF THE CRITICAL CURRENT DENSITY OF $Nb_3Al_{0.8}Ge_{0.2}$ RIBBON. Lohberg, R.; Eagar, T. W.; Puffer, I. M.; Rose, R. M. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Ribbons with the nominal composition $Nb_3Al_{0.8}Ge_{0.2}$ were fabricated. These ribbons have cross sections of 0.01 × 0.25 cm, and have, according to x-ray diffraction, almost entirely the beta-tungsten crystal structure. Transition temperatures for such ribbons generally run from 17 to 19.5°K at midpoint (T_c for the ribbons reported on here have not been measured yet), depending on processing. At present, some of the results of our first measurements of the critical current density in transverse applied magnetic fields up to 15.0 T, and temperatures from 4.2 to 16°K are reported. (auth)

28854 (CONF-720908–, pp 542-547) STABILITY CRITERIA FOR THIN SUPERCONDUCTORS SUBJECTED TO EXTERNAL PERTURBATIONS. Boyer, L.; Fournet, G.; Mailfert, A. (Laboratoire Central des Industries Electriques, Fontenay-aux-Roses, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A criterion for the occurrence of flux jumps in superconducting thin sheets subjected to infinitesimally small perturbations was proposed by Hancox, leading to the elaboration of adibatically stabilized filamentary conductors. Here, it is shown how this criterion is modified for the case of a finite perturbation. Relations are established which allow one to take into account the deviations of the different parameters of the superconductor (temperature, current density) from their equilibrium values. Each external perturbation being assumed as disturbing the initial values of the parameters, the perturbations are determined initiating either a limited or a full flux jump, even for a superconductor obeying to the classical criterion of adiabatic stability. This method allows one to take into account the heat transfer to the surrounding medium, and thus to give a more general criterion for initiation of flux jumps in a superconducting sheet with external heat transfer. (auth)

28855 (COO-3156-54) TRANSITION TO THE MIXED STATE IN LEAD FILMS AT 4.2K. Dolan, G. J.; Silcox, J. (Cornell Univ., Ithaca, NY). 1972. 9p. (CONF-720833-30). Dep. NTIS $3.00.

From 13th international conference on low temperature physics; Boulder, Colorado, USA (20 Aug 1972).

The decoration technique developed by Traeuble and Essmann (Phys. Stat. Sol., 18: 813(1966)) was applied to make direct observations of the microscopic magnetic structure in thin Type-I films. The observations for evaporated lead films at 4.2°K are reported for thicknesses ranging from 200 to 20,000 Å. (MHR)

28856 (IS-Trans-89) ORDER EFFECT IN THE V_3Au SUPERCONDUCTOR: ELECTRONIC OR PHONONIC EFFECT. Junod, A.; Bellon, P.; Fluekiger, R.; Heiniger, F.; Muller, J. Translated from Phys. Kondens. Mater.; 15: 133-141(1972). 11p. Dep. NTIS $3.00.

Specific heat measurements from 1 to 40°K give some insight into the phonon spectrum of the alloy V_3Au. The minute differences between the as-cast and annealed states indicate that the drastic change of the superconducting transition temperature upon ordering is not likely to be of phononic origin. Alternatively; this behavior can be understood as a consequence of an electronic density-of-states change in the presence of a large Coulomb pseudopotential term. This assumption is supported by susceptibility measurements. (auth)

28857 (JUL-CONF-6(VOL.2), pp 833-841) SUPERCONDUCTIVITY IN THE PALLADIUM–HYDROGEN AND PALLADIUM–NICKEL–HYDROGEN SYSTEMS. Skoskiewicz, T. (Kamerlingh Onnes Laboratorium, Leiden). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The electrical resistance of palladium–hydrogen and palladium–nickel–hydrogen samples was measured in the temperature range 1.25 to 10°K. A broad transition to superconductivity was found. The shape and the position of the transition are strongly dependent on hydrogen concentration. (auth)

28858 In_2Bi: AN INTRINSIC TYPE-II SUPERCONDUCTING COMPOUND. Ullmaier, H. (Kernforschungsanlage, Juelich, Ger.); Cruceanu, E. Rev. Roum. Phys.; 17: No. 5, 547-551(1972).

Measurements of magnetic properties of superconducting In_2Bi are reported. The single-crystal samples exhibit almost reversible magnetization curves and have resistivity residual ratios between 60 and 72. The results of the measurements in the superconducting state together with those of additional galvanomagnetic measurements allow estimates of some electronic constants of In_2Bi. The electron meanfree paths calculated in this way are about 14 times longer than the coherence length, i.e., the pure limit is approached very closely. This leads to the conclusion that In_2Bi is an intrinsic type-II superconducter with a Ginzburg–Landau parameter $\kappa = 0.95 \pm 0.05$. The transition temperature is $T_c = 5.87 \pm 0.01$°K and the thermodynamic critical field at T = 0 is 590 Oe. (auth)

28859 QUASIPARTICLE RELAXATION AND PHONON EMISSION IN SUPERCONDUCTING TUNNEL JUNCTIONS. Dynes, R. C.; Narayanamurti, V. (Bell Telephone Labs., Inc., Murray Hill, NJ). Solid State Commun.; 12: No. 5, 341-344 (1 Mar 1973).

Using Sn/I/Sn tunnel junctions as generators and detectors of high frequency phonons, the temperature dependence (down to 0.3°K) of the derivative of the detected signal as a function of generator bias is reported. For $T \lesssim 1$°K the expected BCS singularity in the signal was observed at a generator bias of 4Δ. An

additional singularity was observed at a bias of 2Δ when the number of injected particles greatly exceeds the number thermally excited. Unlike the 4Δ peak, the temperature of occurrence of the 2Δ peak depends markedly on generator impedance (injection rate) as expected. The data provide strong evidence that Tewordt's model (strictly valid for T = 0°K), in which an excited quasi particle relaxes predominantly in a single step to the gap edge before recombination, is correct in the temperature range $T/T_c < 0.3$ and for low injection rates. (auth)

28860 CALCULATION OF POTENTIAL GRADIENTS IN A MOVING NORMAL REGION WITHIN A SUPERCONDUCTING THIN FILM. Barker, D. C. (Univ. of Manchester, Eng.). J. Comput. Phys.; 11: No. 3, 333-347(Mar 1973).

A possible realization of Crane's "Neuristor" active transmission line uses a superconducting thin film superimposed on a normally conducting thin film or substrate. Its performance is dependent on velocity-induced asymmetries of the temperature distribution in a small moving normal region within the superconducting film. The temperature distribution is a function of local Joule heat generation in the normal region (and adjacent conductor). It is, therefore, necessary to obtain information on the current density (or potential gradient) distribution in this area. Here, the numerical solution to the potential gradient problem is discussed. Conditions for convergence of the iterative program for E_x are derived and tested. Computation errors are estimated for E_x and for the continuity equation solution for E_y. Typical results are presented for two values of displacement velocity, using a 37 × 37 node mesh. (auth)

28861 SUPERCONDUCTIVITY IN CUBIC AND HEXAGONAL STRUCTURES. Rajput, J. S. (Regional Coll. of Education, Bhubaneswar, India). Indian J. Pure Appl. Phys.; 10: No. 8, 628-629(Aug 1972).

The occurrence of superconductivity in different types of crystal structures is discussed. Assuming unfilled band electrons as uniformly distributed in the clear space left between the ions, the relationship of the square of the density of unfilled band electrons and the transition temperature is discussed. (auth)

28862 COLLECTIVE EXCITATIONS IN SUPERCONDUCTORS. Fazakas, A. B.; Ciobanu, G. (Inst. of Physics, Bucharest). Physica; 63: No. 2, 384-392(15 Jan 1973).

The problem of collective excitations in a short-range interaction model of a superconductor is studied by means of the Bethe–Salpeter equation for a matrix of vertex functions. Goldstone bosons and exciton-like modes are found in the limit of vanishing momentum. The relation between the coupling constant and the existence of these excitations is discussed. (auth)

28863 PENETRATION DEPTH AS THE UPPER SIZE LIMIT FOR TYPE-II SUPERCONDUCTOR JOSEPHSON JUNCTIONS. Janocko, M. A.; Ashkin, M.; Jones, C. K. (Westinghouse Research Labs., Pittsburg). Phys. Lett.; 43A: No. 4, 345-346(26 Mar 1973).

A vortex model for type-II Dayem bridge Josephson junctions and a vortex size estimate which includes the extent of the circulating current indicate that the penetration depth is the critical junction size parameter, not the coherence length. Experimental verification is given. (auth)

28864 MEAN LIFETIME OF THE PERSISTENT CURRENT IN A TWO-DIMENSIONAL SUPERCONDUCTOR. Parisi, G. (CNEN, Frascati, Italy). Phys. Lett.; 43A: No. 4, 379-380(26 Mar 1973).

Using an approximate form of the time-dependent Ginzburg–Landau equation it is found that in a two-dimensional system quasi-persistent currents are present, their mean lifetime exponentially larger. (auth)

28865 NONEQUILIBRIUM EXCITATIONS IN SUPERCONDUCTORS IN HIGH-FREQUENCY FIELDS. Ivlev, B. I.; Lisitsyn, S. G.; Eliashberg, G. M. (Inst. of Theoretical Physics, Moscow). J. Low Temp. Phys.; 10: No. 3-4, 449-468(Feb 1973).

It was shown previously that the change of distribution by the field leads to so-called stimulated superconductivity, which is considered in detail here. Nonlinearities arising in the expression for current in the third order in the field amplitude are studied. The properties of nonequilibrium excitation at T = 0 are investigated particularly. (MHR)

28866 CRYOELECTRONICS. Jolly, W. P. Halsted Press Book. New York; John Wiley and Sons, Inc. (1972). 96p. $7.95.

Topics covered include: low-temperature effects in conductors, insulators, and semiconductors; superconduction in machines, magnets, and cables; microwave effects, cryotrons, and memories. (WDM)

28867 STEADY-STATE STABILITY OF INTERNALLY COOLED SUPERCONDUCTORS. Todoriki, I. Denki Shikensho Iho; 36: No. 12, 831-850(1972). (In Japanese).

Some calculation methods are described for determining the steady-state temperature profiles of internally cooled superconductors, a part of which is in the state of flux flow by heating with a heater. It is possible to determine the steady-state stability of hollow superconductors from the temperature profiles. The stability is found to be strongly influenced not only by Stekly's parameter but also by a parameter directly related to the mass flow of coolant. The latter parameter is inversely proportional to $(V_g \cdot D_h)^{0.6}$, where V_g is the mass flow of coolant and D_h is the hydraulic diameter of the coolant passage. The criterion for the stable operation of hollow superconductors is that the temperature of conductors (or that of coolant) in the downstream region does not exceed $(1-I/I_c)$, where I_c is the critical current of the superconductors under the ambient field at the initial temperature of coolant. (auth)

28868 OSCILLATIONS OF A TYPE-II SUPERCONDUCTOR IN A MAGNETIC FIELD. Galaiko, V. P. (Physical-Technical Inst. of Low Temperatures, Kharkov). JETP Lett. (USSR) (Engl. Transl.); 17: No. 1, 21-25(5 Jan 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 1, 31-35(5 Jan 1973).

In previous experiments, a superconducting cylinder in the mixed state executed small axial oscillations in a magnetic field perpendicular to the cylinder axis, and the dependence of the frequency and the damping decrement of the oscillations on the field, temperature, sample purity, and other factors was measured. Here, elementary theoretical considerations are presented that explain the unusual character of these relations (the damping in the superconducting state is larger than in the normal state). The increase of the oscillation frequency in the mixed state is evidence of the presence of a "frozen-in" magnetic field in the sample; this field is produced by Abrikosov vortices pinned by various defects. It turns out that the assumed presence of free and pinned vortices suffices also to explain the dependence of the damping coefficient on the magnetic field. (MHR)

Equipment and Devices

Refer also to abstracts 27705, 27755, 28358, 28362–28364, 28373, 28374, 28379, 28412, and 28413.

28869 (CONF-720908–, pp 18-25) HYBRID MAGNETS. Weggel, R. J. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Neither those magnets employing superconductors alone nor those employing resistive conductors alone are capable of the most economical generation of continuous magnetic fields above approximately 20 T. A so-called "hybrid system," which consists of a large-bore superconducting magnet surrounding a small-bore, high-current-density resistive magnet, however, can generate fields above those possible with a purely superconducting magnet, and at a substantial saving in conductor volume and/or power over that required by a purely resistive magnet. This power consumption has been computed by an equation which acknowledges all the major causes that make a high-field magnet less efficient than a low-field one: decreased space factor to preserve adequate cooling, increased magnet temperature, and increased conductor resistivity associated with the stronger conductors needed to withstand the greater magnetic stresses. The formula computes the field generated by a coil of specified bore consuming a specified amount of power, assuming that the fraction of conductor removed to provide cooling and the temperature rise in the coil each are proportional to the square root of the power to be consumed, and that the 20°C resistivity of the conductor is either that of copper or else proportional to the maximum stress in the coil, approximated by the product of the inner radius, the current density there, and the total field there, including the contribution of the coil itself. The wire cost of the superconducting magnet required to bring the total field up to its prespecified value is computed assuming tape-like conductors carrying 1,000 A and cryostatically stabilized at a heat flux of 0.5 W/cm². The cost per meter of this conductor has been estimated as $\$/m = \$_1 V_{Cu} + \$_2 V_{Sc} + \$_3$, where V_{Cu} and V_{Sc} are the volumes of copper and superconductor in a meter of a conductor, and the coefficients are calibrated from existing conductors. The three hybrid systems now being tested at Oxford University (16 T, 2 MW), M. I. T. (22 T, 5 MW), and McGill University (25 T, cryogenic insert), and a brief study of the pro-

posed Nijmegen system (25 T, 6 MW) are reviewed. The fact that this system should require only $50,000 or so of wire, whereas a purely resistive magnet, even of massive dimensions, would require an additional 5 MW of power, attests to the value of the hybrid concept. (auth)

28870 (CONF-720908–, pp 26-28) DERIVATION OF THE HIGH ACCURACY FORMULAS FOR THE MAGNETIC FIELD OF A BITTER MAGNET AS A FUNCTION OF ITS POWER CONSUMPTION. Weggel, C. F. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

More accurate formulas are needed to predict accurately the performance of any magnet system incorporating resistive coils if the central field is greater than approximately ten teslas. To be accurate, such formulas must take into account the following factors: the true "effective" radial space factor resulting from the sacrifice of conductor volume for cooling passages; the increase in the average operating temperature of the magnet and the consequent increase in the conductor resistivity; and the reduction in the axial space factor due to the necessary sacrifice of conductor volume for reinforcing sheets to enable the coil to withstand the enormous stresses produced by the interaction of the magnet current with the ambient magnetic field. The basic equations required to derive the high accuracy formulas are: the field-generation equation, the power-consumption equation, the conductor resistivity equation, the temperature-rise equation, the stress equation, the mechanical strength equation, and the axial space factor equation. (MHR)

28871 (CONF-720908–, pp 29-40) SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEMS. Brechna, H.; Arendt, F.; Heinz, W. (Kernforschungszentrum, Karlsruhe, Ger.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Magnetic energy storage systems capable of storing energies in the order of 10^{10} J or higher will be required within the next decade to provide the magnetic fields in thermonuclear fusion reactors. Here, various aspects for pulsed and steady state magnetic storage systems capable of providing the energies mentioned are discussed. The coil size and maximum central field in the magnet system are limited by the magnetomechanical forces, which require special high strength stabilized conductors and appropriate coil reinforcements. Problems of safety, shielding of electromagnetic fields, switching, thermal losses, and economic considerations are presented. (auth)

28872 (CONF-720908–, pp 41-48) LIGHTWEIGHT SUPERCONDUCTING MAGNET FOR A TEST FACILITY OF MAGNETIC SUSPENSION FOR VEHICLES. Hirai, K.; Akiyama, S.; Fujino, H.; Onodera, K. (Fuji Electric Co., Ltd., Nagasaki). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

For the magnetically suspended high speed train a lightweight superconducting magnet is required. As one of the preliminary studies, such a lightweight magnet for a magnetic suspension test facility was constructed and magnetic suspension experiments were performed. The design concept of the cryostat was based on a tubular structure, but modified partially for the requirement of the facility. The cryostat includes a pair of C-shaped modified race-track coils with thermally operated persistent switches. Supports to carry the lift forces induced on the coils are composed of FRP tubes with hinge connectors. The conductor of coils is the twisted multifilamentary superconducting composite. The main features of this magnet are given. The magnet worked very stably in the externally excited mode and the persistent mode. The maximum levitating height was 80 mm. (auth)

28873 (CONF-720908–, pp 70-79) EXPERIMENTAL STUDIES ON MAGNETICALLY SUSPENDED HIGH-SPEED TRAINS USING LARGE SUPERCONDUCTING MAGNETS. Ogiwara, H.; Takano, N.; Yonemitsu, H. (Toshiba Research and Development Center, Kawasaki, Japan). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

In order to study the behavior of a superconducting magnet used for a magnetically suspended high-speed train, large superconducting magnets of 0.3 m × 1.2 m were constructed. The maximum field was 27 kG at the designed operating current of 500 A. The cool-down characteristics and the field on and around the superconducting magnets were studied. The electromagnetic forces acting on the superconducting magnets were determined using a "static levitation experiment" facility. In the static test, the rigidity of the cryostats against the lift and transverse forces acting on the superconducting coils inside the cryostats were tested. The superconducting magnet was levitated gradually from 3 cm to 6.5 cm high above the ground coil by increasing current of the ground coil. The critical characteristics of the transverse stabilization was revealed in this experiment. The dynamic tests using a disc track of 3.1 m in diameter which had twelve sets of the ground coil and the stabilizer coil of 0.3 m × 0.6 m were also performed. The disc track rotated up to the rim speed of 120 km/hr to the fixed superconducting magnet. The lift and drag forces were simultaneously recorded on a two-pen recorder, and their perturbations due to the consecutive structure of the track and the suspension mechanism of the superconducting magnet were also studied. The induced currents in the track coils were measured and compared with the results from the theoretical study on a coil-track system. The sheet track of the aluminum sheets of 10 mm and 30 mm thick were also studied using the rotating disc. (auth)

28874 (CONF-720908–, pp 227-232) SUPERCONDUCTING SHIELDS FOR MAGNETIC FLUX EXCLUSION AND FIELD SHAPING. St. Lorant, S. J. (Stanford Linear Accelerator Center, CA). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Superconducting shields provide a means of obtaining arbitrarily reduced magnetic fields over considerable volumes for use in diverse applications. Various shielding techniques for high and low flux densities are surveyed and some recent results discussed. In particular, the flux shielding properties of laminates of Nb_3Sn were studied in fields up to 2.5 T. Measurements are presented on the shielding efficiency of the laminate as a function of the number of lamellae, the properties of overlap regions, and the methods of construction. The practical application of these devices is illustrated. (auth)

28875 (CONF-720908–, pp 233-236) 15 TESLA SUPERCONDUCTING MAGNET. Vallier, J. C. (Centre National de la Recherche Scientifique, Grenoble, France). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A superconducting magnet which was recently constructed using a mixed-winding of Nb–Ti and Nb_3–Sn and designed to produce a field of about 15 Tesla with good homogeneity in a volume of several tens of cm^3 is described. The performance of the magnet was studied at 4.2 K. Large instabilities in Nb_3–Sn were found, which make it necessary to vary the field of the magnet very slowly (about 7 G/sec in high field). The behavior of the latter is strictly controlled for successive thermal quenches. The protection is assured by suitably chosen external resistances. A large fraction (85%) of the stored energy is transferred. (auth)

28876 (CONF-720908–, pp 237-240) HORIZONTAL DIPOLE SUPERCONDUCTING MAGNET USING MULTILAYER INSULATION. Iwamoto, M. (Mitsubishi Electric Corp., Amagasaki, Japan); Satow, T.; Tanaka, M.; Ogino, O.; Akashi, K.; Ishihara, K.; Fushimi, K. 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

A new type of horizontal dipole superconducting magnet using multilayer insulation was built and tested successfully. In the magnet new multilayer insulators were mounted in the vacuum space of a cryostat. The anisotropic expansive magnetic forces acting on the coil windings are transmitted through the multilayer insulators to the mechanical girders in a space at room temperature and supported. The magnet has a horizontal bore to which a room temperature access is provided for MHD generator research channel: A central field of 20 kG is generated in the working bore of 21.4 cm diam. The coil is wound with a solder-type composite superconductor (Ti–Nb–Ta and copper substrate). The cryostat is 160 cm long, 85 cm OD including the girders. (auth)

28877 (CONF-720908–, pp 252-264) ELECTROMAGNETIC LOADING OF DEWAR SHELLS AS A RESULT OF TIME VARYING MAGNETIC FIELDS. Stekly, Z. J. J.; Thome, R. J. (Magnetic Corp. of America, Waltham, MA). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The currents induced in dewar shells due to time-varying coil currents are analyzed. The analyses are restricted to the central sections of the shells where end effects can be neglected. Solenoids and dipole coils are considered. While a solenoid coil will result in loading either radially inward or radially outward (a loading similar to internal or external uniform pressure), it is concluded for dipole coils that, although the absolute values of surface loading are not generally large, the fact that they are nonuniformly distributed around the periphery may result in excessive deflections. (auth)

28878 (CONF-720908–, pp 265-270) REVIEW ON THE PERFORMANCE LIMITS OF A LARGE SUPERCONDUCTING MHD MAGNET. Bohn, T.; Komarek, P. (Kernforschungsanlage, Juelich, Ger.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The magnet under discussion was built for research in closed-cycle-MHD energy conversion to be in operation with the largest existing loop "Argas." Special features of the design are great accessibility for diagnostics and sufficient space for the electrodes. The design was made for 4T and will be described shortly. The magnet coil design created energizing problems which have been investigated using different power supplies, i.e., different charging circuits. Thereby interesting effects could be observed. They can be explained by an imperfect part of either the wire or the winding in one of the coils and by the special winding construction with shunting strips across each layer. (auth)

28879 (CONF-720908–, pp 301-305) WINDINGS FOR SUPERCONDUCTING MACHINES. Mulhall, B. E. (International Research and Development Co. Ltd., Newcastle-upon-Tyne, Eng.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Superconducting electrical machines may be homopolar, for dc applications, or heteropolar, for ac generators. In the former the superconducting field windings are large solenoids, while in the latter they are similar to beam handling dipoles or quadrupoles. Machine windings are discussed with particular regard to the specification of the superconductor, and compared with magnets for other applications. The discussion is illustrated by machines being designed or built at IRD. (auth)

28880 (CONF-720908–, pp 339-346) RESIDUAL FIELDS IN SUPERCONDUCTING MAGNETS. Green, M. A. (Kernforschungszentrum, Karlsruhe, Ger.). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The residual field phenomena in superconducting magnets becomes important when one must operate these magnets at low as well as high fields. Residual fields are caused by circulating currents in the superconducting filaments and circulating currents between the filaments through normal conducting metal. The former produces frequency independent fields; the latter type of residual field is frequency dependent. The theory for residual fields in various kinds of superconducting magnets is presented. The reason for the undesirable multipole content of the residual field is explained and methods for reducing or eliminating the effects of residual fields in superconducting magnets are discussed. (auth)

28881 (CONF-720908–, pp 517-520) TWISTED, MULTIFILAMENT Nb_3Sn SUPERCONDUCTIVE RIBBON. Coles, W. D. (Lewis Research Center, Cleveland). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

An experimental study of superconductor stabilization has resulted in the successful application of the concepts of filamentary structure and conductor twist to Nb_3Sn ribbon. The Nb_3Sn is formed in parallel, helical paths, which are continuous around the ribbon. Short lengths (12 to 18 cm) of 1.27 cm wide superconductive ribbon have been produced. The filamentary and twist characteristics are incorporated in the ribbon by means of an inert mask formed on the ribbon surface early in the fabrication process. Diffusion reaction of the niobium and tin is prevented at the filament boundaries. Described are the conductor methods of fabrication, and test results obtained. The technology required to adapt the processes for the production of long lengths of ribbon is available. (auth)

28882 (CONF-720908–, pp 607-616) CIRCULAR-APERTURE DIPOLE AND QUADRUPOLE MAGNETS: SHAPE, FIELD, ENERGY STORAGE, BODY-FORCES, AND IRON SHIELD. Iwasa, Y.; Weggel, R. J. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The work of Beth and of Asner was extended to the design of circular-aperture dipoles and quadrupoles of arbitrarily great winding depth. The ID, OD, and bounding angles of each annular wedge of current are chosen to best make the field multipolar outside as well as inside the system. This allows the use of high-permeability shell to enhance the central field and reduce the fringing field without degrading the central homogeneity. Formulas are also presented for the field and magnetic energy storage, the magnetic body forces, and the thickness of iron needed to avoid saturation. (auth)

28883 RELATION BETWEEN TRANSIENT PROCESSES AND CONTROL CONDITIONS ON THE ONE HAND AND THE PARAMETERS OF A SUPERCONDUCTING CABLE IN A DC TRANSMISSION LINE ON THE OTHER. Bogachkov, M. L.; Glinternik, S. R. Izv. Akad. Nauk SSSR, Energ. Transp.; No. 4, 14-20(1972). (In Russian).

The relation between the parameters of a superconducting cable on the one hand and transient processes in a dc line and control conditions to limit the maximum emergency currents in the case of interterminal short circuits on the other is studied. An estimate is made of the effect of individual parameters on the static stability of a controllable superconducting dc electric power transmission line. The analysis shows that with the existing cost of cryogenic materials and equipment, a nominal working voltage of the order of 100 kV should be used in such a line. A reduction in voltage would make the cable more expensive, while an increase would raise the cost of transforming equipment as well as increasing overloads. In order to limit overloads during emergencies in the transmission of direct current, a current regulator should be used which is based on a rectifier with channels for deviation and for the integral of the current. In the case of disruptions in the operation of the channel for the integral of the current when there is a short circuit in the dc line, the rectified current attains a new value determined by the coefficient of amplification with respect to deviation. When there is a failure in the channel for deviation, the rectified current returns to the initial value; this process takes place slowly since attenuation is sharply reduced. In the case of disruptions in the operation of the channels for deviation and for the integral of the current, the rectified current gradually goes to the new steady-state value, which is quite high since it is determined only by the resistance of the rectifier commutation circuit. In designing a cryogenic cable for a dc transmission line, the wave impedance of the cable must be maximized since this has a favorable effect on transmission operating stability. (JPRS)

28884 DC VOLTAGES INDUCED BY MICROWAVE IRRADIATION IN SUPERCONDUCTING POINT JUNCTIONS. Dmitrienko, I. M.; Bevza, Yu. G.; Mikhailov, V. A. (Physical-Technical Inst. of Low Temperatures, Kharkov). JETP Lett. (USSR) (Engl. Transl.); 17: No. 1, 4-6(5 Jan 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 1, 8-11(5 Jan 1973).

The observation, in the absence of transport current, of dc voltages induced by microwave radiation in damped point junctions is reported here. Point junctions produced by mechanical pressure of a needle point against the flat end surface of a wire were investigated. Nb/Nb and Nb/Sn junctions were studied. The junction was placed in a standard 3-cm waveguide perpendicular to the broad wall of the waveguide in an antinode of the electric field, a quarter-wavelength away from the short-circuiting plunger. Continuously-varying as well as quantized dc voltages induced by the microwave radiation were observed, in junctions having a monotonically-decreasing dependence of the critical current on the magnetic field, typical of "singly-connected" junctions, as well as in junctions with an oscillating $I_c(H)$ dependence, typical of "multiply-connected" junctions (superconducting interferometers). (MHR)

PHYSICS (NUCLEAR)

Neutron Interactions with Matter

Refer also to abstracts 29027 and 29128.

28885 (EUR-4948) GAP CODE FOR THE PREPARATION AND MODIFICATION OF THE LIBRARY FOR THE PINOCCHIO AND HEROIC CODES. Daolio, C. (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). Apr 1973. 66p. (In Italian). Dep. NTIS (U. S. Sales Only) $5.50. EUR BF 85.-.

The GAP code is a code used to prepare, or to modify, the library of neutron cross-sections for the PINOCCHIO and HEROIC codes. The code is a modified version of the GAM-II and GATHER-II codes. (auth)

28886 (INDC(SEC)-32-U) WRENDA 73: WORLD REQUEST LIST FOR NEUTRON DATA MEASUREMENTS FOR NUCLEAR REACTORS. (International Nuclear Data Committee). Mar 1973. 156p. Dep. NTIS (U. S. Sales Only) $10.00.

A list of world-wide requests for neutron data measurements is given. Explanations of the table arrangement and the terminology used are included. (RWR)

28887 REDUCTION OF MULTIPLE SCATTERING BY A SANDWICH STRUCTURE OF THE SAMPLE IN NEUTRON SCATTERING EXPERIMENTS. Kalli, H. (Helsinki Univ. of Tech., Otaniemi, Finland). Nucl. Instrum. Methods; 108: No. 1, 11-12 (1973).

The possibilities of reducing multiple scattering in neutron scattering experiments by using a sandwich structure of the sample with alternating slices of the scatterer and an absorbing material are discussed. The quantitative results in a simple neutron transport case are obtained by Monte Carlo estimation. (auth)

28888 CALCULATION OF LANDAU'S FERMI-LIQUID PARAMETERS IN PURE NEUTRON MATTER. Baeckman, S. O. (Abo Akademi, Finland); Kaellman, C. G.; Sjoeberg, O. Phys. Lett.; 43B: No. 4, 262-266(19 Feb 1973).

The Landau parameters F_0, F_1, G_0 and G_1 have been calculated in pure neutron matter including the interaction induced by exchange of density–density and spin–density excitations at densities up to $k_F = 2.5$ fm^{-1}. The main effect of the induced interaction is to make the matter more incompressible. (auth)

28889 MULTIPLE SCATTERING AND TRANSPORT OF NEUTRONS. Nishigori, T. (Osaka Univ., Suita, Japan). J. Nucl. Energy; 27: No. 3, 171-183(Mar 1973).

The collision term in the quantum-mechanical transport equation of neutrons derived by Osborn and others (1965) is reformulated with the aid of the S-matrix theory of scattering, and the usual transport equation is generalized to include the effect of multiple scattering of neutrons. It is shown that the random phase approximation is no longer necessary by virtue of the adiabatic switching off of interactions. A semi-quantitative analysis of the effect of multiple scattering is made on the basis of the free gas model, and it is concluded that the validity of the usual transport equation depends on the spatial resolution, the energy of the neutron under consideration, and the energy spectrum of all neutrons. The usual transport equation is not valid for a very cold neutron (of energy below 0.0001 eV), and not generally valid for a cold neutron when the energy spectrum of the neutrons is softer than Maxwellian. It is also inapplicable to a neutron of any energy when the spatial resolution is not much less than the mean free path of the neutron. (auth)

28890 EFFECT OF MULTIPLE SPIN SPECIES ON SPHERICAL SHELL NEUTRON TRANSMISSION ANALYSIS. Semler, T. T. (Lewis Research Center, Cleveland). J. Nucl. Energy; 27: No. 3, 185-191(Mar 1973).

A series of Monte Carlo calculations have been performed in order to evaluate the effect of separated vs merged spin statistics on the analysis of spherical shell neutron transmission experiments for gold. It is shown that the use of separated spin statistics consistently results in larger average capture cross sections of gold at 24 keV. This effect is explained by stronger windows in the total cross section caused by the interference between potential and J_+ resonances and by J_+ resonances and by J_+ and J_- resonance overlap allowed by the use of separated spin statistics. Using the latest published separated spin statistics, the value of the average capture cross section for gold at 24 keV is 710 ± 25 mbarn. (auth)

28891 THERMAL NEUTRON TRANSPORT NEAR A MODERATOR DISCONTINUITY USING THE METHOD OF WEIGHTED RESIDUALS. 2. COLD NEUTRON SOURCES. Moon, J. R.; Beynon, T. D. (Univ. of Birmingham, Eng.). J. Phys., D (London); 6: No. 4, 427-448(28 Feb 1973).

Using the method of weighted residuals, a detailed numerical study was made of the neutronics of spherical cold neutron sources composed of liquid hydrogen and liquid deuterium in reactor moderators of light water, heavy water, and graphite. Particular attention was paid to the physical effects at the cold source boundary. The computations allowed a number of conclusions to be made on the best designs of spherical cold source configurations. It was found that for small spherical sources there was little difference in neutron gain using either normal-hydrogen or para-hydrogen, and that the largest gains were obtainable from large deuterium-filled sources. (auth)

28892 REMARKS ON THE PREHISTORY OF THE DISCOVERY OF SLOW NEUTRONS. Goldhaber, M. (Brookhaven National Lab., Upton, NY). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 191-195(1972).

The statement made by Fermi and quoted in Segre's book on Fermi (Enrico Fermi: Physicist (1970) Univ. of Chicago Press) about the discovery of slow neutrons at the Institute of Physics of the University of Rome on October 22, 1934 is given. The fact that this reveals that Fermi was not, as many thought, led to the discovery of slow neutrons rationally from an observation of an anomaly when the neutron source was placed on a wooden table is most intriguing. The author reveals how he came so close to the discovery of slow neutrons a few months before Fermi's discovery. Reproductions of two early drafts of a paper written by J. Chadwick and the author dated probably late July 1934 including speculative interpretations of their work which includes references to "slow neutrons" are reproduced. However these speculations were left out of the final version. (UK)

28893 COMPLETE BACK SCATTERING EFFECTS IN NEUTRON WAVE PROPAGATION PROBLEM. Goyal, I. C.; Ghatak, A. K.; Singh, O. P.; Sobhana, S. (Indian Inst. of Tech., New Delhi). pp 625-638 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28894 TRANSPORT OF ONE SPEED NEUTRONS. Ghatak, A. K. (Indian Inst. of Tech., New Delhi); Bala, S.; Bansal, N. K.; Sobhana, S. pp 639-657 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28895 NEW VARIATIONAL METHOD FOR PULSED NEUTRON PROBLEM. Ahmed, F.; Saini, S. (Univ. of Delhi). pp 659-665 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28896 GENERALISED FORMULATION OF THE CONTINUOUS SLOWING DOWN OF NEUTRONS. Sengupta, A.; Srikantiah, G. (Indian Inst. of Tech., Kanpur). pp 667-669 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

28897 CORRELATION BETWEEN RESONANCE AND GREULING–GOERTZEL APPROXIMATIONS. Sengupta, A.; Srikantiah, G. (Indian Inst. of Tech., Kanpur). pp 671-673 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28898 INFLUENCE OF THE HYDROGEN BOND ON NEUTRON SPECTRA AND EFFECTIVE CROSS SECTION IN A ZIRCONIUM HYDRIDE MEDIUM. Naumov, V. A.; Semashko, A. P. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 11-16(1972). (In Russian).

Investigations of hydrogen atom chemical binding influence on neutron spectra and the analytical model of effective cross sections in zirconium hydride are discussed. Free-gas and Nelkin–Rosenbluth models of the scattering law for the transport equation are used. (4 figures) (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 27768, 28624, 28628, 28933, 28948, 29034, 29035, and 29210.

28899 COULOMB–NUCLEAR INTERFERENCE IN p–d ELASTIC SCATTERING AT 600 MeV. Jargeaix, B.; Lefort, A. Gardes, J.; Meritet, L.; Pauty, J. F.; Querrou, M.; Peynet, G.; Vazeille, F. (Univ., Clermont-Ferrand, France). J. Phys. (Paris), Colloq.; No. 5, 147(1972).

A 600-MeV experiment recently performed to determine the real part of the p–n forward scattering amplitude using the Coulomb–nuclear interference occurring in p–d elastic scattering is presented. (FR)

28900 MULTIPLE SCATTERING OF 156.5-MeV PROTONS ON A = 3 NUCLEI. Narboni, P. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 154(1972). (In French).

The differential cross sections for 156.5-MeV ^{3}H(p,p)^{3}H, ^{3}He(p,p)^{3}He, and ^{3}H(p,n)^{3}He reactions were analyzed using Glauber theory. A computer program was written which included the NN scattering amplitude in complete form, with account taken of target spin and (p,n) charge exchange up to third order. The results show the importance of multiple scattering. (1 figure) (RWR)

28901 SECOND COULOMB ENERGY DIFFERENCES OF ISOSPIN TRIPLETS IN THE 2s–1d SHELL. Rappleyea, C. A. (Univ. of Colorado, Boulder). Nucl. Phys., A; A203: No. 2, 295-304 (1973).

Second Coulomb energy differences, which in the present case are proportional to the tensor Coulomb energy, are calculated for 0^+, T = 1 ground states in the region $18 \leq A \leq 42$ using a shell model that includes a pairing interaction. The calculation is done with a mathematical formalism that includes p-n pairs as well as p-p and n-n pairs. Besides an enhancement of proton-pair Coulomb energies, the pairing interaction is responsible for lowering the Coulomb energy of N = Z members of isospin triplets and also gives rise to an important term in the second energy difference. Using pairing strengths derived from fitting energy levels for mass-18 and mass-42 nuclei, results of the calculation reproduce experimental second energy differences extremely well. (auth)

28902 β-DECAY OF TRITIUM. Piel, W. F. Jr. (Indiana Univ., Bloomington). Nucl. Phys., A; A203: No. 2, 369-387(1973).

A measurement of the high-energy part of the β-spectrum of tritium is made using a magnetic spectrometer. The present work incorporates a cooled Si(Li) detector to determine the energy of the β-rays after momentum selection by the magnetic spectrometer. This "energy signaturetechnique" effectively discriminates against background and scattered electrons. The calibration of the spectrometer is accomplished by recording the ^{195}Pt K99 (20.5 keV) and the ^{195}Pt $L_1$31 (17.0 keV) internal conversion lines. These two lines bracket the end-point energy of tritium. The present value of 18.578 ± 0.040 keV for the tritium end-point energy agrees with a recent measurement by Bergkvist but disagrees with several other measurements. The data are consistent with assigning a zero rest mass to the electron's antineutrino and allow an upper limit of 100 eV/c^2 to be set, assuming that effects due to degenerate Fermi seas of neutrinos and antineutrinos are negligible. On the other hand, assuming a zero rest mass for the electron's antineutrino, the data allow an upper limit of 150 eV to be set for the Fermi energy E_F of a degenerate sea of neutrinos; and the data are consistent with $E_F = 0$ eV. (auth)

28903 PROTON–PROTON BREMSSTRAHLUNG AND THE ^{2}H(p,2p)n REACTION AT 51.8 MeV. Sanada, J.; Kondo, K.; Seki, S. (Tokyo Univ. of Education). Nucl. Phys., A; A203: No. 2, 388-400(1973).

Proton–proton bremsstrahlung cross sections were measured at 33°-33° and 8.5°-8.5° with a coplanar symmetric geometry. A comparison between experimental cross sections and theoretical predictions was made. The ^{2}H(p,2p)n reaction was also investigated at 12.5°-12.5° and 8.5°-8.5°. The cross sections $d^3\sigma/d\Omega_1 d\Omega_2 dE_1$ were compared with the values calculated by existing theories. (auth)

28904 MICROSCOPIC CALCULATION FOR THE REACTIONS ^{3}H(p,p)^{3}H, ^{3}He(n,n)^{3}He, AND ^{3}H(p,n)^{3}He. Heiss, P.; Hackenbroich, H. H. (Univ., Cologne). Nucl. Phys.; A202: No. 2, 335-363(1973).

Starting from a nucleon-nucleon potential containing soft-core central, spin-orbit and tensor forces a resonating group calculation for ^{4}He scattering states was performed. All possible couplings of p-^{3}H and n-^{3}He channels were considered but the d-d channels were neglected. Cross sections and polarization values resulting from this calculation were compared with experimental data for both elastic p-^{3}H and n-^{3}He scattering and the ^{3}H(p,n)^{3}He reaction. Generally the agreement between theory and experiment is good; some discrepancies resulting from the neglect of d-d channels are discussed. (auth)

28905 ENERGY DEPENDENCE OF TRANSITION STRENGTHS EXTRACTED FROM ^{12}C(τ,α) AND ^{16}O(τ,α). Fuchs, H.; Oeschler, H. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Nucl. Phys.; A202: No. 2, 396-402(1973).

The (τ,α) reaction on ^{12}C and ^{16}O has been studied at 24 and 28 MeV bombarding energy. Differential cross sections have been obtained and analyzed with DWBA to yield relative spectroscopic factors. The comparison with results obtained at lower bombarding energies shows that the strengths of some anomalous shell model-forbidden transitions decrease with energy. This agrees qualitatively with the prediction of a reaction model which assumes a cluster substitution mechanism to explain the anomalous (τ,α) transitions. (auth)

28906 DETAILED ANALYSIS OF ^{3}H FROM FADDEEV EQUATIONS IN CONFIGURATION SPACE. Laverne, A.; Gignoux, C. (Institut des Sciences Nucleaires, Grenoble, France). Nucl. Phys.; A203: No. 3, 597-608(1973).

The Faddeev equations are presented in configuration space, together with a method for solving the three-particle bound states. Triton observables are calculated for four realistic nucleon–nucleon interactions of Reid and of de Tourreil and Sprung. Two-body correlations in the triton are given, as well as the corrections to the triton energy from neglected interaction states. It is concluded that the relevance of the triton for distinguishing different local realistic nucleon–nucleon interactions is questionable. (3 figures, 8 tables) (auth)

28907 CHARGE FORM FACTOR OF ^{3}He. Yadav, H. L.; Raghavan, S. S.; Srivastava, B. K. (Indian Inst. of Tech., Kharagpur). pp 117-121 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28908 EFFECT OF TENSOR FORCES ON (γ,p) DISINTEGRATION OF ^{4}He. Yadav, H. L.; Mahanti, D.; Srivastava, B. K. (Indian Inst. of Tech., Kharagpur). pp 137-141 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28909 TOTAL NEGATIVE MUON CAPTURE RATE IN THE α-PARTICLE. Srivastava, B. K.; Mahanti, D.; Yadav, H. L. (Indian Inst. of Tech., Kharagpur). pp 149-152 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28910 BINDING ENERGY OF ^{3}H IN THE UNITARY POLE APPROXIMATION USING A HARD-CORE POTENTIAL. Maheshwari, C.; Mathur, V. S.; Lagu, A. V. (Banaras Hindu Univ., India). pp 223-226 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28911 NEUTRON SCATTERING CROSS SECTION FOR LIQUID METHANE. Rao, K. R.; Dasannacharya, B. A. (Bhabha Atomic Research Centre, Trombay, India). pp 619-623 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28912 APPLICATION OF THE MONTE CARLO METHOD TO THE EVALUATION OF THE COINCIDENCE SPECTRUM OF A NUCLEAR REACTION. Moesner, J.; Schmidt, G.; Stiehler, T. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Exp. Tech. Phys.; 20: No. 6, 489-495(1972). (In German).

The Monte Carlo Method was used to determine physical parameters from a measurement of a coincidence spectrum of the nuclear reaction ^{3}He(d,pt)p. The simulation of an event by means

of random numbers is described in detail. Each event was weighted according to a physical model and summing up the weights the simulated spectrum was constructed. Using the χ^2-test this spectrum is compared with the experimental spectrum. Choosing a certain set of parameters an acceptable agreement could be achieved. (auth)

28913 IMPROVEMENTS IN THE DETERMINATION OF β-SPECTRA END-POINT ENERGIES. Bergkvist, K. E. (Univ. of Stockholm). pp 77-93 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Comments are made on the possibilities of an increase in absolute accuracy in β-spectra end-point energy determination. The various conditions encountered when formulating the requirements for this improved accuracy are illustrated by means of measurements on the tritium β-spectrum. (UK)

28914 RECENT DETERMINATION OF THE ATOMIC MASSES OF H, D, ^{35}Cl, AND ^{37}Cl AT OSAKA UNIVERSITY. Katakuse, I.; Ogata, K. (Osaka City Univ.). pp 153-163 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Early difficulties with the focussing characteristics of the Osaka University mass spectrometers have been overcome. The methods employed to determine the atomic masses of H, D, ^{35}Cl and ^{37}Cl are given. The masses were determined by measuring the mass differences of nine doublets. The accuracy of the doublet mass difference is estimated to be between a few times 10^{-5} and several times 10^{-6}, depending on the doublet separations. The accuracy of the atomic masses determined is estimated to be 1 to 4×10^{-8}. (UK)

28915 NUCLEAR MATTER CALCULATIONS. Sprung, D. W. L. (McMaster Univ., Hamilton, Ont.). Advan. Nucl. Phys.; 5: 225-343(1972).

After an introduction to the theory, a method for the calculation of the G matrix is explained in some detail; various aspects of this method are considered under the topics: general principles, Bethe-Goldstone equation, Kallio-Day method, reduction to partial waves, Day's derivation of the radial wave equation, binding energy, and the Brueckner self-consistency problem. The following methods for constructing the G matrix are then compared: Kallio-Day method, Koehler's method and related methods, Tabakin-Haftel method, Coester-Day-Vincent-Cohen method, Brueckner-Gammel method, Dahl-Ostgaard-Brandow method, and Moszkowski-Scott method. The results of calculations for realistic forces are discussed in general terms with respect to the following points: potentials considered, results for local phenomenological potentials, importance of various partial waves, results for OBEP and supersoft-core forces, interpretation of OBEP forces, mechanism of saturation in nuclear matter, convergence of the reference spectrum series, average center-of-mass momentum, and symmetry energy. In addition, minimal relativity, three-body forces, phase-equivalent potentials, nuclear matter without potentials, and saturation conditions on the two-body potential are treated. Higher-order cluster contributions are examined, including three-body clusters, intermediate-state potential energy and three-body clusters, and four-body clusters in nuclear matter. Finally, various aspects of calculations for finite nuclei are discussed under the headings rationale, local density approximation, Thomas-Fermi theory, effective potentials, and neutron star matter. (27 figures, 7 tables, 203 references) (RWR)

28916 NUCLEON-NUCLEON EFFECTIVE RANGE EXPANSION PARAMETERS. Noyes, H. P. (Stanford Univ., CA). Annu. Rev. Nucl. Sci.; 22: 465-484(1972).

The failure of charge independence in the $^1S_0$ state and the significance of the OPE shape correction are discussed in the introduction. Because knowledge of the NN interaction is clouded, this review does not simply report how well-defined parameters have been evaluated by a sequence of precise experiments, but instead explains how very different numbers are obtained for what superficially appear to be the same physical quantities. Coulomb effects and vacuum polarization are discussed in connection with the determination of pp effective range parameters and analysis of pp scattering below 10 MeV. nn effective range parameters are then considered; prediction of a^s_{nn} and r^s_{nn} from charge symmetry and attempts to measure a^s_{nn} and r^s_{nn} by using final-state interactions are covered. np parameters are discussed under the following headings: np S-wave bound-state and zero-energy parameters, $^3S_1$ shape effects and the $^3D_1$ state, analysis of np total cross sections to determine r^s_{np}, and calculations of r^s_{np} assuming charge independence. Finally, a series of recommended values is discussed for shape-independent pole approximations and split np, nn, and pp parameters. (1 figure, 67 references) (RWR)

28917 PROTON-PROTON QUASIFREE SCATTERING IN ^{2}H(p,2p)n REACTION AT 40 MeV. Beatty, P. H. College Station, TX; Texas A and M Univ. (1972). 118p. University Microfilms Order No. 73-3510.

Thesis (Ph. D.).

The reaction ^{2}H(p,2p)n was studied experimentally with particular regard to proton-proton quasifree scattering for 40 MeV bombarding energy. It was verified that the data for several detector configurations could be combined together and be shown to depend primarily on the spectator neutron momentum. A comparison was made of the data with a simple impulse approximation scaled by a factor of one-third and a modified simple impulse approximation (MSIA) using a cutoff radius of 6.46 Fermis. The experimental data had a peak value common to that of the MSIA theory and a FWHM value about midway between that of the two theories. (Diss. Abstr. Int., B)

28918 ELASTIC SCATTERING OF 14 MeV NEUTRONS FROM ^{3}He. Curtis, R. H. Providence; Brown Univ. (1972). 90p. University Microfilms Order No. 73-2253.

Thesis (Ph. D.).

The differential cross section for neutrons scattered elastically from ^{3}He at 14.08 MeV has been measured in the angular range 27 to 137° (c.m.). This data complements that taken by Antolkovic, Paic, Tomas and Rendic at 14.4 MeV in the angular range 99 to 167° (c.m.). The experimental results are compared to the resonating group calculations of Bransden, Robertson and Swan. Calculations based on the Serber exchange interaction agree very well at center of mass angles less than 95°, but at the larger angles the calculated values tend to fall 30 to 50% too high. The depth of the minimum at the center of mass angle is not at all well reproduced, the calculation falling a factor of three above the data. The integrated elastic cross section is within 2% of the calculated value. Possible reasons for the disagreement between the calculated and experimental values are discussed. (Diss. Abstr. Int., B)

28919 τ-d OVERLAP FUNCTION AND THE τ CHARGE FORM FACTOR. Lim, T. L. (Drexel Univ., Philadelphia). Phys. Lett.; 43B: No. 5, 349-350(5 Mar 1973).

An Eckart-form parametrization of the τ-d overlap function is shown to give excellent fits to the τ charge form factor and radius. The function is constrained to have the correct asymptotic behavior and successfully reproduces the diffraction dip at 11.6 fm^{-2}. (auth)

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 28901, 28911, 28958, 28964, 28978, 29003, 29027, 29034, 29053, 29054, 29057-29060, 29067, 29163, 29181, 29214, 29220, and 29242.

28920 (FRNC-TH-333) EXPERIMENTAL AND SEMI-EMPIRICAL STUDY OF THE SPALLATION OF LIGHT NUCLEI. Application to the Nucleosynthesis of Li, Be, and B in the Galaxy. Rey Campagnolle-Epherre, M. (Paris Univ., Orsay (France)). 1972. 102p. (In French). Dep. NTIS (U. S. Sales Only) $7.25.

Thesis.

Nuclear reactions likely to occur in the formation of Li, Be, and B by the interaction of galactic cosmic radiation with interstellar gas were studied in the laboratory. In cosmic radiation and the interstellar medium, hydrogen nuclei represent about 90% of the atoms present, and helium atoms, about 10%. The formation of Li, Be, and B in spallation reactions induced by α particles and protons was studied. The formation cross sections of ^{6}Li, ^{7}Li, ^{7}Be, ^{9}Be, and ^{10}Be, produced by the interaction of 160-MeV α particles with oxygen were measured. The formation cross sections for ^{7}Be and ^{11}C in nitrogen irradiated with 6- to 40-MeV protons were measured together with the ^{7}Li/^{6}Li (1.2 ± 0.2) spallation ratio at 50 MeV. In order to complete the results, different models for estimating the cross sections for targets having mass numbers between 12 and 30 were studied. A computer simulation of a two-stage spallation model was utilized. The cross sections were calculated for ^{12}C, ^{14}N, and ^{16}O irradiated with protons having energies of the order of 100 . V, different types of cascade being considered. The break-up fo[illegible]alism was used. The results are compared with calculations on evaporation. A semi-empirical formalism for evaluating the nonmeasured cross sections using 3 parameters which demonstrate the importance of the isotopic

spin and the α sub-structures in these reactions was obtained. The nucleosynthesis model obtained explains the abundances of ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B observed in stars and the solar system as well as the abundances of these elements in cosmic radiation. (auth)

28921 (ORNL-TM-4157) INTEGRAL NEUTRON SCATTERING MEASUREMENTS ON CARBON FROM 1 TO 20 MEV. Morgan, G. L.; Love, T. A.; Perey, F. G. (Oak Ridge National Lab., Tenn.). Apr 1973. Contract W-7405-eng-26. 60p. Dep. NTIS $5.00.

The spectrum of neutrons above ~1 MeV scattered by a thick (3.81 cm) carbon ring was measured as a function of the incident neutron energy over the range from 1 to 20 MeV. Data were taken for three angles: 60°, 90°, and 135°. A linac (ORELA) was used as a neutron source with a 47-m flight path. Incident energy was determined by time of flight, while scattered spectra were determined by pulse-height unfolding techniques. The results of the measurement are presented in forms suitable for comparison to calculations based on the evaluated neutron data files. (11 figures, 10 tables) (auth)

28922 ELASTIC SCATTERING OF α-PARTICLES BY ^{12}C AND THE STRUCTURE OF ^{16}O. Terasawa, T. (Tokyo Univ.); Tanifuji, M.; Mikoshiba, O. Nucl. Phys., A; A203: No. 2, 225-243(1973).

Scattering of α-particles by ^{12}C has been investigated by the coupled-channel method in the weak-coupling model of the α-particle and ^{12}C nucleus. For ^{12}C the rotational model is adopted and the α-particle is simply treated as a point particle. Spin and angular momentum dependent interactions have been taken into account as a correction to the α-^{12}C potential. We calculated the energies and widths of the resonance levels, the energies of the two bound states, the phase shifts, the excitation functions and the angular distributions of the differential cross sections, up to E_α = 8 MeV. The experimental data are reasonably well reproduced. The deformation parameter of the α-^{12}C potential is considerably different from that of the nucleon-^{12}C potential. The reason for this difference is discussed. (auth)

28923 REACTIONS OF ^{14}N AND ^{16}O IONS WITH LIGHT NUCLEI AT E_{lab} = 16 TO 58 MeV. Holub, R. (Florida State Univ., Tallahassee); Zeller, A. F.; Choppin, G. R.; De Meijer, R. J.; Plendl, H. S. Phys. Lett., B; 43B: No. 5, 375-376(5 Mar 1973).

Yield curves for formation of ^{7}Be and other radio-nuclides from bombardment of C, Al and Si targets with 16 to 58 MeV ^{14}N and ^{16}O ions were measured. The ^{7}Be yields disagree by several orders of magnitude with Hauser-Feshbach and transition-state predictions. The other yields are in order-of-magnitude agreement with nucleon and/or α-particle evaporation calculations. (auth)

28924 STUDY OF SOME TWO-NUCLEON PICK-UP REACTIONS IN THE 1p SHELL WITH 39.8 MeV PROTONS. Hoot, C. G.; Olsen, D. K.; Brown, R. E.; Maxwell, J. R.; Scott, A. (Univ. of Minnesota, Minneapolis). Nucl. Phys., A; A203: No. 2, 339-352(1973).

Differential cross sections at a proton energy of 39.8 MeV (lab) have been measured for the following reactions (energies in MeV): ^{12}C(p,τ)^{10}B(g.s., 0.72, 1.74, 2.15, 3.59), ^{14}C(p,t)^{12}C(g.s., 4.43), ^{14}N(p,τ)^{12}C(g.s., 4.43), and ^{16}O(p,τ)^{14}N(g.s., 2.31, 3.95). A zero-range DWBA analysis of the data has been performed using the 1p shell wave functions of Cohen and Kurath. The fits we find are overall somewhat worse in shape than those found in the (p,t) survey of the 1p shell performed by Kahana and Kurath, the principal reason being that of the (p,τ) transitions which proceed with both L = 0 and L = 2 components we find several which occur with a much weaker L = 0 strength than the calculations predict. When ratios of experimental integrated cross sections to DWBA integrated cross sections are compared for all transitions, an rms deviation about the mean of 39% of the mean is found, whereas if only ratios for transitions from a given target nucleus are compared, then the rms deviations are considerably smaller. (auth)

28925 STUDY OF ^{14}N USING THE ^{13}C(d,n)^{14}N REACTION. Bobbitt, J. R. III; Etten, M. P.; Lenz, G. H. (Univ. of Virginia, Charlottesville). Nucl. Phys., A; A203: No. 2, 353-368(1973).

Absolute differential cross sections for the ^{13}C(d,n)^{14}N reaction were measured at deuteron bombarding energies of 4.5, 5.0 and 5.5 MeV. Spectroscopic factors and statistical compound-nucleus contributions are obtained by treating the observed cross sections as an incoherent sum of distorted-wave Born approximation and compound-nucleus contributions. Energy-averaged spectroscopic factors are derived. An anomaly is observed in the yield for the 2.313 MeV T = 1 state. (auth)

28926 EXCITED STATES OF ^{16}O BETWEEN 13.5 AND 15.0 MeV. Martin, Ph.; Ophel, T. R. (Australian National Univ., Canberra). Nucl. Phys.; A202: No. 2, 257-264(1973).

A comprehensive analysis has been performed of measurements of the ^{12}C(α,α_0) and ^{12}C(α,α') reactions within the range of incident α-particle energies 8.5-10.5 MeV. A description of the experimental data was possible in terms of six levels of ^{16}O: 4^+ (13.8 MeV), 0^+ (14.0 MeV), 3^- (14.2 MeV), 4^+ (14.6 MeV), 5^- (14.6 MeV) and 6^+ (14.8 MeV). (auth)

28927 DWBA ANALYSIS OF THE REACTION ^{12}C(α,n)^{15}O. Corcalciuc, V.; Duma, M.; Dumitrescu, R.; Minzatu, I.; Ciocanel, A. (Inst. of Atomic Physics, Bucharest). Nucl. Phys.; A202: No. 2, 377-384(1973).

Angular distributions of neutrons from the reaction ^{12}C(α,n)^{15}O(g.s.) have been measured at lab energies from 18.4 to 23.1 MeV and angles ranging from 0° to 130°, using a time-of-flight technique. The experimental curves generally show a forward peaking and a strong dependence on the incident energy. The data were compared with the angular distributions predicted by the distorted-wave theory of direct nuclear reactions, and no agreement could be obtained when only a stripping mechanism was taken into account. (auth)

28928 SYMMETRY STUDIES OF THE SEQUENTIAL REACTION ^{7}Li(d,αn)^{4}He. Heggie, J. C. P.; Martin, P. W. (Univ. of British Columbia, Vancouver). Phys. Lett.; 43B: No. 4, 289-291(19 Feb 1973).

Measurements of the α-n angular correlation in the sequential reaction ^{7}Li(d,α)^{5}He(g.s.) → ^{4}He + n indicate that the ^{5}He intermediate state does not break up symmetrically about the recoil center-of-mass system. The angular correlation can be explained in terms of a compound nuclear reaction proceeding through levels in ^{9}Be. (auth)

28929 ANGULAR MOMENTUM TRANSFER IN NUCLEON EXCHANGE SCATTERING OF HEAVY IONS. Gelbke, C. K. (Max-Planck Institut fuer Kernphysik, Heidelberg); Bock, R.; Braun Munzinger, P.; Fick, D.; Hildenbrand, K. D.; Weiss, W.; Wenneis, S.; Baur, G. Phys. Lett.; 43B: No. 4, 284-286(19 Feb 1973).

The elastic scattering of ^{16}O on ^{17}O has been measured at E_{lab} = 24, 28 and 32 MeV and $\theta_{c.m.}$ = 90 to 150°. At large energy the cross section exhibits a structureless rise at backward angles which can be described consistently with the DWBA approach for the elastic transfer. (auth)

28930 INELASTIC AND CHARGE-EXCHANGE SCATTERING OF HIGH ENERGY PROTONS BY LIGHT NUCLEI. Karapetyan, V. V.; Mileev, V. N.; Titarenko, N. N. (Moscow State Univ.). Nucl. Phys.; A203: No. 3, 561-577(1973).

Inelastic and charge-exchange scattering of nucleons were examined using a single-inelastic-scattering approximation and including the effects of multiple scattering within the framework of Glauber's theory. Integral cross sections for the discrete-level excitation in the inelastic scattering and charge-exchange scattering of protons were calculated for a number of 1p shell nuclei, and the asymptotic behavior of these cross sections was analyzed. It was shown that in these transitions the main contribution comes only from several states of the final nucleus. The role of multiple-scattering effects was investigated with respect to the structural features of the nucleus. The angular correlations (p,p'γ) were examined in connection with the possibility of distinguishing the partial transitions from secondary photons. (5 figures, 3 tables) (auth)

28931 ^{16}O(d,^{3}He) EXCITATION SPECTRUM. Faessler, A. (Kernforschungsanlage, Juelich, Ger.); Kusuno, S.; Strobel, G. L. Nucl. Phys.; A203: No. 3, 513-531(1973).

The ^{16}O(d,^{3}He) excitation spectrum was calculated in the framework of the Gross-Lipperheide model, which explicitly takes into account the effect of residual interactions and the decay of the residual nucleus by particle emission. The reaction mechanism is described by the DWBA for a direct pickup reaction. The theory is extended to include the higher-order effects of the residual interaction on the self-energy operator, in terms of which the spectral function is expressed. The real part of the self-energy operator is calculated up to the fourth order (2p-3h configurations) in the strength of the residual interaction. The calculation of the self-energy operator up to the second order yields the leading term only for separation energy below 38 MeV. Higher-order effects are important for separation energies as low as 10 MeV. The Lemmer-Shakin potential is used for the residual interaction. The calculated spectrum exhibits a shell structure of groups of narrow peaks, which depends very much upon the choice of the absorption potential for the ^{3}He optical parameters. (6 figures, 7 tables) (auth)

28932 MICROSCOPIC CALCULATION OF THE GROUND STATE AND THE FIRST POSITIVE PARITY STATE OF ^{9}Be. Fuld-Rouserez, M. (Univ., Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 58: No. 7, 894-911(1972). (In French).

A microscopic calculation of the intrinsic energies of the ground state and of the first positive-parity state (at 1.75 MeV) of the ^{9}Be nucleus is presented. We generalize the cluster model of Brink to a two α-particle system with an additional neutron described by means of a definite-parity molecular wave function. The variational calculation is made by using spherical and spheroidal orbitals. (auth)

28933 CAPTURE REACTION Q-VALUES WITH SUB-keV ACCURACY. van der Leun, C.; de Wit, P. (State Univ., Utrecht). pp 131-139 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The question as to whether the reduction of errors in Q-values into the sub-keV range warrants the effort is discussed. The method of measurement of Q-values by measurement of the resonance energy relative to one or more of the thoroughly studied calibration resonances and the measurement of the γ-ray energies relative to that of a series of well known calibration γ lines is outlined. Precision Q-values for which precise calibration energies are not required are discussed, and the possible use of thermal-neutron capture calibration lines is considered. It is thought that the high precision obtained in Q-value measurements in capture reactions opens a way to measure the mass-difference of almost all the light nuclei with good accuracy. (UK)

28934 SHELL MODEL MASSES AND NUCLEAR STRUCTURE. Zeldes, N. (Hebrew Univ., Jerusalem). pp 245-254 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The experimental basis and connections of a shell model mass equation are described. The importance of nuclear structure considerations, the nuclear potential, the pairing scheme, subshell mixing and deformation, and light nuclei are discussed. (UK)

28935 MULTI-STEP PROCESSES IN THE ^{12}C(^{3}He,α)^{11}C REACTION. Singh, R. N. (McGill Univ., Montreal); de Takacsy, N.; Hayakawa, S. I.; Hutson, R. L.; Kraushaar, J. J. Nucl. Phys., A; A205: No. 1, 97-120(1973).

We give a general discussion of the multi-step nucleon transfer reaction, and the conditions under which a coupled-channel analysis is necessary. The ^{12}C(^{3}He,α)^{11}C reaction cross sections are measured and analyzed in detail, and it is concluded that a complete coupled-channel analysis is required to explain the cross sections properly. In particular, the effect of the feedback from the pick-up channels on the elastic and inelastic channels is shown to be very important. (auth)

28936 ANALOGUE STATES IN ^{13}C, ^{19}F, AND ^{31}P. Gunye, M. R.; Warke, C. S. (Tata Inst. of Fundamental Research, Bombay). pp 1-4 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28937 EXCITATION FUNCTION FOR THE GAMMA-RAY YIELDS FROM ALPHA PARTICLE BOMBARDMENT OF ^{19}F IN THE RANGE 3.96 TO 4.55 MeV. Balakrishnan, M.; Mehta, M. K.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 13-17 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28938 MEASUREMENT OF NONELASTIC CROSS SECTIONS AT 14.2 MeV. Pal, B.; Chatterjee, A.; Ghose, A. M. (Bose Inst., Calcutta). pp 33-36 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28939 DETAILED ANALYSES OF THE ^{7}Li(p,pt)^{4}He REACTION. Jain, A. K.; Sarma, N. (Bhabha Atomic Research Centre, Trombay, India). pp 123-128 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28940 ^{12}C(p,2p)^{11}B REACTION AT 75 MeV. Chatterjee, A.; Deutchman, P. (Univ. of Idaho, Moscow). pp 129-131 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28941 PHOTOPRODUCTION OF CHARGED PIONS FROM ^{16}O IN THE SAXON-WOODS BASIS. Srinivasa Rao, K. (MATSCIENCE, Madras). pp 143-148 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28942 RECOIL NUCLEAR POLARIZATION IN MUON CAPTURE. Devanathan, V.; Parthasarathy, R.; Subramanian, P. R. (Univ. of Madras). pp 157-160 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

28943 ABSORPTION OF 2p PION FOLLOWED BY THE EMISSION OF TWO NEUTRONS ON ^{12}C NUCLEUS. Jain, B. K. (Bhabha Atomic Research Centre, Trombay, India). pp 165-169 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28944 PION ABSORPTION AND THE STRUCTURE OF ^{6}Li NUCLEUS. Jain, B. K. (Bhabha Atomic Research Centre, Trombay, India). pp 171-177 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28945 STABILITY OF EXCITED STATES AND BAND CUT-OFF IN LIGHT 4N-NUCLEI. Satpathy, L. (Univ. of Berhampur, India); Priedrich, H.; Weiguny, A. pp 299-304 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28946 NEUTRON CHANNEL IN MUON CAPTURE BY ^{15}N AND ^{32}S. Bely, Yu. I. (Moscow State Univ.); Eramzhyan, R. A.; Majling, L.; Rizek, J.; Vartanyan, V. A. Nucl. Phys.; A204: No. 2, 357-370(1973).

The excitation of giant resonances in muon capture by the nonmagic nuclei ^{15}N and ^{32}S is considered. The capture rates to the levels of the intermediate nuclei ^{15}C and ^{32}P as well as neutron decay channels and spectra were calculated. The features of giant resonances in nonmagic nuclei are discussed, and possibilities of experimentally checking the results obtained are suggested. (auth)

28947 TOTAL REACTION CROSS SECTION OF α-PARTICLES ON CARBON BETWEEN 15.8 AND 20.1 MeV. Labie, E.; Lega, J.; Leleux, P.; Macq, P. C. (Univ., Louvain, Belgium). Nucl. Phys.; A205: No. 1, 81-89(1973).

A beam attenuation technique has been used to measure the total reaction cross section of α-particles with carbon between 15.8 and 20.1 MeV. The results show a significant dip near the previously observed resonance in the elastic scattering at 18.5 MeV. An l-dependent optical model is used to analyze the data; the rotator model is applicable to the 18.5 MeV resonance. (auth)

28948 CLUSTERING IN LIGHT NUCLEI. Arima, A. (State Univ. of New York, Stony Brook); Horiuchi, H.; Kubodera, K.; Takigawa, N. Advan. Nucl. Phys.; 5: 345-477(1972).

After some introductory comments on few-nucleon correlations, clustering, the four-body correlation, normal shell-model states, and excited rotational levels and molecule-like structure, the shell model and deformed Hartree-Fock model are discussed, as well as the weak-coupling model and quartet states. Various

aspects of the cluster model are then treated in more detail: cluster wave functions, Brink's method, generator-coordinate method and treatment of relative motion between clusters, the LCCO (linear combination of cluster orbitals) method, adiabatic conditions, and Hamiltonian. The cluster model is then applied to the nuclei ^{6}Li, ^{8}Be, ^{12}C, ^{16}O, and ^{20}Ne. Electromagnetic properties and form factors for electron scattering are then examined for ^{6}Li, ^{12}C, and ^{20}Ne. The comparison between models in the normal shell-model states and the effect of the spin–orbit interaction and hybridization are then discussed. Exotic states and alpha-particle widths are addressed; alpha-transfer reactions are the best way to study the four-body correlation. A method to calculate matrix elements between two Brink wave functions is briefly described in an appendix. (35 figures, 31 tables, 189 references) (RWR)

28949 DIFFERENTIAL CROSS SECTION AND POLARIZATION FOR NEUTRONS SCATTERED FROM ^{10}B AT 2.63 MeV. Cox, J. M. Athens, OH; Ohio Univ. (1972). 129p. University Microfilms Order No. 73-4226.

Thesis (Ph. D.).

Little information exists concerning the T = ½ levels of ^{11}B above ~13 MeV. In particular, the only thing known about the 14.0 MeV level is the width obtained from total cross section measurements. The purpose of the present work is to extend the previous neutron scattering data to higher energy and to attempt to determine some of the properties of the 14.0 MeV level of ^{11}B. To do this, the differential cross section and polarization for 2.63 MeV neutrons scattered from ^{10}B were measured at eight angles from 18 to 123 degrees c.m. The neutrons were produced by the D(d,n)^{3}He reaction using a pure aluminum drive-in target with a 120 keV deuteron beam. Neutron pulse shape discrimination and associated particle time-of-flight techniques were employed. A spin-precession solenoid magnet was used in the measurement of the asymmetry. A companion experiment with ^{12}C produced the value of the source polarization and the absolute efficiencies of the neutron detectors. Multiple scattering and finite geometry corrections have been made. The finite geometry calculations included the effects of the thick target and the finite associated particle detector. The data obtained in this experiment are predominantly influenced by the broad resonance at 2.8 MeV lab energy (14.0 MeV excitation energy). Attempts to fit the region of 11 MeV to 15 MeV excitation energy with R-matrix parameters for states in ^{11}B have been made. Based on this single level (plus constant background) R matrix analysis, the level at 14.0 MeV is assigned positive parity (l = 2) and a spin of $^{11}/_{2}$ or $^{3}/_{2}$. Concerning the anomaly near 13.1 MeV, some spin and parity assignments have been suggested, but there is a question of whether there is only one level, or whether there are two overlapping levels present. Since the inclusion of the 14.0 MeV level greatly influences the calculations near 13.1 MeV, the assignments for this region were re-examined. No assumption of a single level at 13.1 MeV gives acceptable predictions. The present analysis agrees with the assumption that there are two levels of opposite parity. The negative parity (l = 1) state at 13.05 MeV has a spin of ($^{3}/_{2}$), $^{5}/_{2}$, or $^{7}/_{2}$. The positive parity (l = 2) state at 13.15 MeV has a spin of $^{3}/_{2}$, $^{5}/_{2}$, or $^{7}/_{2}$. (Diss. Abstr. Int., B)

28950 LOW ENERGY PROTONS FROM C, Al, Ni, Cu, AND Au UNDER 600 MeV PROTON BOMBARDMENT. Orr, H. D. III Columbia, SC; Univ. of South Carolina (1972). 124p. University Microfilms Order No. 73-610.

Thesis (Ph. D.).

One method of treating the interaction of high-energy protons (energies greater than 100 MeV) with complex nuclei is by means of the cascade-plus-evaporation model. In this model, the proton-nucleus interaction is treated as proceeding in two steps: A series of two-body scattering reactions takes place among the incident particle and individual nucleons in the nucleus – the cascade process; subsequently, the excitation energy imparted to the nucleus is released by neutron and charged particle emission analogous to the thermodynamic behavior of a drop of heated liquid cooling by boiling off molecules – the evaporation process. To assess the applicability of this model an experiment was performed using the external beam of 600 MeV protons at the Space Radiation Effects Laboratory to irradiate thin targets of carbon (polyethylene), aluminum, nickel, copper, and gold. The secondary protons emitted in the energy range from 2 to 14 MeV were identified and their energy measured using a solid-state detector telescope. Proton spectra were obtained at 20°, 45°, 90°, 110°, and 120° with respect to the incident beam direction. The absolute differential cross sections as a function of secondary proton energy, calculated from each spectrum, compare well with other experimental results. The agreement of the present results with predictions based on Monte Carlo calculations is fair for light nuclei and excellent for medium mass nuclei; however, large discrepancies exist between the theoretical and experimental results for heavy nuclei. These differences probably arise because the particular theoretical model examined does not take into account sensitivity of the coulomb barrier to excitation energy. For each target-angle combination, an attempt was made to fit the cross sections with a constant-plus-Maxwellian distribution, representing a simple cascade-plus-evaporation spectrum. Estimates of the cascade and evaporation cross sections and of the nuclear temperature show no significant variations with angle but definite dependences on nuclear mass. These mass-dependences are interpreted as effects of nucleon number, neutron/proton ratio, and charge distribution. It is concluded that the cascade-plus-evaporation model yields reasonably good predictions of the secondary proton yield for light and medium mass nuclei, although recoil of the lighter nuclei may be significant in modifying the energy spectra. For heavier nuclei, the theoretical predictions are poor. (Diss. Abstr. Int., B)

28951 STUDY OF THE $(\alpha,2\alpha)$ REACTION ON ^{12}C, ^{16}O, ^{26}Mg, AND ^{28}Si AT E_{α} = 70 MeV. Mroz, G. J. College Station, TX; Texas A and M Univ. (1972). 192p. University Microfilms Order No. 73-556.

Thesis (Ph. D.).

The $(\alpha,2\alpha)$ reaction on ^{12}C, ^{16}O, ^{26}Mg, and ^{28}Si was studied in a kinematically complete experiment at α-particle bombarding energy of 70 MeV. Energy and angular correlations between the two outgoing α-particles were obtained by measuring the energies of these two particles in coincidence. Both quasi-elastic α-α scattering and the two step sequential process contributions to the $(\alpha,2\alpha)$ reaction cross sections were observed. The experimental results were compared to calculations based on the plane wave impulse approximation (PWIA) with a cut-off radius and harmonic oscillator wave-functions for the relative motion of the bound α-cluster. Significant distortion effects were observed which could not be explained with the PWIA, but some of the gross features in the reaction cross section were reproduced by this approximation. (Diss. Abstr. Int., B)

28952 EXPERIMENTAL STUDY OF THE ^{9}Be(p,π^{+})^{10}Be AND ^{9}Be(p,π^{-})^{10}C REACTIONS AT 185 MeV. Dahlgren, S.; Grafstroem, P.; Hoeistad, B.; Asberg, A. (Univ. of Uppsala). Nucl. Phys.; A204: No. 1, 53-64(1973).

A magnetic spectrometer was used for the momentum analysis of pions produced by 185-MeV protons on a ^{9}Be target. The obtained energy resolution (0.55 MeV FWHM) made it possible to resolve a number of discrete final states in ^{10}Be and ^{10}C. Energy spectra were measured in the angular region 15 to 30° (lab). Angular distributions for six peaks in ^{10}Be and four peaks in ^{10}C are presented in tables and graphs. A peak corresponding to a not previously reported level in ^{10}Be was observed at 11.75 ± 0.11 MeV excitation energy. The measured π^{+}/π^{-} ratio for the ground state analogs was found to be angular dependent and varied from 30 at 35° (lab) to 2 at 125° (lab). The results are compared with theoretical predictions and discussed in terms of one- and two-nucleon models. (auth)

28953 NUCLEON EXCHANGE IN THE SCATTERING OF CARBON ISOTOPES. Bohlen, H. G. (Max-Planck-Institut fuer Kernphysik, Heidelberg); Feil, M.; Gamp, A.; Marquardt, N.; von Oertzen, W.; Kohlmeyer, B. J. Phys. (Paris), Colloq.; No. 5, 59(1972).

The elastic scattering of ^{12}C on ^{13}C and ^{14}C, and of ^{13}C on ^{14}C, was experimentally studied at energies between 12 and 20 MeV; structures were observed in the angular distributions. (FR)

28954 PRODUCTION PROCESS EFFECTS IN THREE-BODY FINAL STATES: ^{10}B(d,α)$\alpha\alpha$ AND ^{9}Be(τ,α)$\alpha\alpha$. Roy, R.; Birchall, J.; Frois, B.; Slobodrian, R. J. (Univ. of Laval, Quebec). Lett. Nuovo Cim.; 6: No. 10, 374-378(10 Mar 1973).

Final-state interaction theories in their simplest form represent enhancements due to strong two-body attractions with a factorized T-matrix element which is a product of a function related to the production process and the initial state and an enhancement factor, F(k). It should be possible to establish whether this is a reasonable approximation i.e., whether F(k) is the same for different entrance channels, and then to evaluate the precision required to detect significant deviations from a zero-order on-energy-shell interpretation on the basis of the experimental evidence. The α–^{8}Be final state was studied by means of the ^{10}B(d,α)^{8}Be and ^{9}Be(^{3}He,α)^{8}Be reactions at 2.0 to 10.0 MeV. Theoretical spectra are compared with experimental data. The main difference between the α spectra obtained through the different entrance channels is simply reducible to a change in branching ratios or relative populations of the two-body states that can be reached. The detailed analysis of single α spectra ascribes the continuum almost completely to the 2^{+} doublet at

16.6 and 16.9 MeV. It is concluded that dominant two-body interactions reproduce well the present three-body final-state spectra obtained from two different entrance channels and possible off-energy-shell transitions, higher-order processes, and other dynamical effects are very weak. (2 figures) (RWR)

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Refer also to abstracts 27693, 28901, 28913, 28914, 28923, 28933, 28934, 28936, 28938, 28945, 28946, 28948, 28950, 28951, 28978, 29001, 29008, 29031, 29072, 29130, 29214, and 29259.

28955 ANOMALOUS M1 TRANSITION IN ^{38}Cl. Maripuu, S. (Michigan State Univ., East Lansing); Wildenthal, B. H.; Evwaraye, A. O. Phys. Lett., B; 43B: No. 5, 368-370(5 Mar 1973).

The observed enchangement of the M1 transition in ^{38}Cl between the 3$^-$ state of the "$d_{\frac{3}{2}}$–$p_{\frac{1}{2}}$ multiplet" and the 4$^-$ state of the "$d_{\frac{3}{2}}$–$f_{\frac{1}{2}}$ multiplet" is explained. (auth)

28956 ELASTIC ELECTRON SCATTERING FROM THE MAGNETIZATION DISTRIBUTION OF ^{27}Al. Lapikas, L.; Dieperink, A. E. L.; Box, G. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nucl. Phys.; A203: No. 3, 609-626(1973).

Cross sections were measured for the scattering of electrons through 180° from Mg, Al, and Si targets in the energy range 35 to 95 MeV. Scattering from the magnetization distribution of ^{27}Al is observed as the difference of the scattering from ^{27}Al and from the neighboring doubly even nuclei Mg and Si. Corrections were applied for differences in instrumental effects and in rms charge radii. Theoretical magnetic cross sections were computed with a single-particle wave function and with a shell-model wave function involving configuration mixing. If the distorted-wave Born approximation is used, good agreement with experiment is obtained. In both cases the best fit to the data yielded a value of the oscillator range parameter b = 1.71 ± 0.06 fm. By using the q dependence of the single-particle model, a value Ω = 18.7 ± 3.5 $\mu_N \cdot fm^2$ for the magnetic octupole moment of ^{27}Al was found. The present low-energy (E < 100 MeV) data are in good agreement with the results obtained from the scattering of high-energy (E = 500 MeV) electrons from ^{27}Al through "normal" angles. (6 figures, 3 tables) (auth)

28957 RECENT DETERMINATIONS OF ATOMIC MASS DIFFERENCES AT THE UNIVERSITY OF MANITOBA. Barber, R. C.; Barnard, J. W.; Bishop, R. L.; Burrell, D. A.; Duckworth, H. E.; Meredith, J. O.; Southon, F. C. G.; Williams, P. (Univ. of Manitoba, Winnipeg). pp 141-152 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

A description is given of the mass spectrometer and of the techniques used to determine atomic mass differences between naturally occurring nuclides in the region of strong nuclear deformation. A value of the ^{37}Cl–^{35}Cl mass difference via the $^{12}C^{35}ClD_2$–$^{12}C^{37}ClH_2$ doublet obtained from methylene chloride with a spacing $\Delta M/M \sim 1/_{3,300}$ is compared with calculated values from previous work. Rare earth mass differences of the types $A_X - A_Y = \Delta_1$, $^{A+2}X^{35}Cl - {}^{A}Y^{37}Cl = \Delta_2$, $^{A+2}X^{35}Cl_2 - {}^{A}Y^{37}Cl_2 = \Delta_3$ have also been studied and are reported. (UK)

28958 ON-LINE MASS SPECTROMETRIC ANALYSIS OF FAR UNSTABLE LIGHT NUCLEI PRODUCED IN HIGH ENERGY NUCLEAR REACTIONS. Present Status and the Prospect of Direct Mass Measurements. Klapisch, R.; Thibault, C. (CNRS, Orsay, France). pp 181-191 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

Experiments to measure the β half-life, using a mass spectrometer, of ^{11}Li (9.0 ms) and five new sodium isotopes ^{27}Na (288 ms) to ^{31}Na (16 ms) are outlined. However, the knowledge of the ground state masses would be required if one wanted to study in more detail the nuclear properties in this region. It was thus decided that mass measurements with an accuracy of 1 MeV or a little better would be valuable. An investigation has been undertaken and is reported into the possibility of measuring directly the masses of ^{11}Li with a precision of 200 keV and of ^{30}Na with a precision around 600 keV. (UK)

28959 ENERGY LEVELS OF ^{23}Na. Meyer, M. A.; Smit, J. J. A. (Potchefstroom Univ., S. Afr.). Nucl. Phys.; A205: No. 1, 177-192(1973).

Proton energies and strengths of 17 resonances in the ^{22}Ne(p,γ)^{23}Na reaction were determined for E_p < 1.1 MeV. A new resonance was observed at E_p = 630.5 ± 1.0 keV. The γ-decay of 17 resonances was studied by means of a 40 cm^3 Ge(Li) detector. The excitation energies and branching ratios of 36 bound levels were determined. A new level was observed at E_x = 8299 ± 3 keV. The lifetimes of the ten E_x = 2.08 to 4.77 MeV levels were determined with the Doppler-shift attenuation method. The spins of the E_p = 725 and 928 keV resonances were determined from angular distribution measurements. Both have J = $^3/_2$. (auth)

28960 β-DECAY OF ^{26}Na. Klotz, G.; Gonidec, J. P.; Baumann, P.; Walter, G. (Centre de Recherches Nucleaires, Strasbourg). Nucl. Phys.; A205: No. 1, 90-96(1973). (In French).

Gamma-rays following the β^- decay of ^{26}Na have been measured with a Ge(Li) detector. The ^{26}Na sources were produced by fast neutron bombardment of an enriched ^{26}Mg sample. Evidence for eight previously unreported β^- branches in the disintegration of ^{26}Na has been deduced and their log ft values determined. The half-life of ^{26}Na was measured to be 1.05 ± 0.02 s. Allowed β^- transitions (log ft = 4.7 and 6.1 respectively) to the 1.81 MeV, 2$^+$, and to the 4.90 MeV, 4$^+$, levels of ^{26}Mg determine J$^\pi$ = 3$^+$ for the ^{26}Na ground state. (FR)

28961 STUDY OF THE ^{26}Mg(^{3}He,α)^{25}Mg REACTION IN THE INCIDENT ENERGY RANGE BETWEEN 9 AND 11 MeV. Notarrigo, S.; Porto, F.; Rubbino, A.; Sambataro, S.; Strazzeri, A. (Univ., Catania, Italy). Nuovo Cim.; 14A: No. 2, 403-421(21 Mar 1973).

An experimental study of the ^{26}Mg(^{3}He,α)^{25}Mg reaction was made. Excitation functions were measured from $E_{^3He}$ = 9.0 to $E_{^3He}$ = 11.0 MeV in steps of 100 keV with a resolution better than 100 keV. Differential cross sections were obtained for α-groups leading to the ground state and to the first four excited levels of the residual nucleus, in the angular range (15 to 150°) in steps of 5°. The angular distributions averaged over the entire explored energy range were compared with a diffractional model and with DWBA calculations. Spectroscopic ratios were derived with both models and comparable results were obtained, however these ratios are not stable against variations in the incident energy for both models. Strong fluctuations are evident in the excitation functions which are cross-correlated between states of the residual nucleus of the same rotational band suggesting some peculiar intermediate structure. (auth)

28962 REACTION MECHANISM STUDIES IN ^{24}Mg(α,$\alpha'\gamma$)^{24}Mg. McNeilly, G. S.; Thompson, W. J.; Van Rij, W. I.; Heydenburg, N. P. (Florida State Univ., Tallahassee). Nucl. Phys.; A204: No. 2, 321-336(1973).

Reaction-plane double differential cross sections were measured for ^{24}Mg(α,$\alpha'\gamma$)^{24}Mg at 16.65 MeV with an 800 keV thick target to provide energy-averaged results. Scattered α-particles were detected from 27.5° to 140° at 7.5° intervals in the lab frame. The γ-detector was moved in the same plane to measure 15-point α'-γ double differential cross sections at each α-angle. Data were obtained for ^{24}Mg(α,$\alpha_1\gamma$)^{24}Mg for ^{24}Mg(α,α_2 + $\alpha_3\gamma$)^{24}Mg. The former data were analyzed with previous elastic-scattering differential cross sections and with (α,α_1) and (α,α_2) cross sections in a DWBA plus Hauser-Feshbach analysis and a coupled-channels plus Hauser-Feshbach analysis. The first three levels of ^{24}Mg were treated as levels of a rotational band. The compound-nucleus contributions are significant at all backward angles and dominate the calculated inelastic cross sections. However, the compound-nucleus contribution is near zero in the angular region 60° to 120° for the anisotropy parameters of the (α,$\alpha_1\gamma$) cross sections. The DWBA plus Hauser-Feshbach fits are in close agreement with the coupled-channels plus Hauser-Feshbach fits for the (α,α') cross sections but show less agreement for the (α,$\alpha_1\gamma$) cross sections. (auth)

28963 INVESTIGATIONS OF NUCLEAR LEVELS IN ^{28}Si BY MEANS OF ^{27}Al(p,γ)^{28}Si REACTION. Rangacharyulu, C.; Jadhao, V. G.; Mehta, G. K.; Singru, R. M. (Indian Inst. of Tech., Kanpur). pp 19-25 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28964 ASYMMETRY OF EMITTED NEUTRONS IN MUON CAPTURE. Devanathan, V.; Parthasarathy, R. (Univ. of Madras). pp 153-156 of Proceedings of the Nuclear Physics

and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28965 POLARIZATION OF EMITTED NEUTRON IN MUON CAPTURE. Devanathan, V. (Univ. of Madras); Parthasarathy, R.; Ramachandran, G. pp 161-164 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28966 EXCITED LEVELS OF ^{20}Ne USING TAMM–DANCOFF APPROXIMATION. Kulkarni, D. R.; Pandya, S. P. (Physical Research Lab., Ahmedabad, India). pp 273-276 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720211-(Vol. 14B).

28967 GENERATOR COORDINATE SPECTRUM OF ^{20}Ne. Khadkikar, S. B.; Kulkarni, D. R. (Physical Research Lab., Ahmedabad, India). pp 277-281 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720211-(Vol. 14B).

28968 CLUSTER MODEL CALCULATIONS FOR ^{24}Mg NUCLEUS. Khanna, K. M. (Univ. of Dibrugarh, India); Sharma, M. L. pp 295-298 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28969 SYSTEMATIC TENDENCIES IN COULOMB WAVE FUNCTIONS. Ramana Murty, M. V.; Ramamurty, S.; Chandran, C. R. (Andhra Univ., Waltair). pp 317-318 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28970 CONVERSION COEFFICIENT MEASUREMENTS IN ^{160}Dy. Venkata Ramaniah, K.; Mallikharjuna Rao, P.; Venkata Reddy, K. (Andhra Univ., Waltair). pp 421-424 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).
From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

28971 APPLICATION OF THE BLOCKING TECHNIQUE TO MEASURE LIFETIMES OF NUCLEAR LEVELS EXCITED IN (p,α) RESONANCE REACTIONS IN P AND Al. Sharma, R. P.; Andersen, J. U.; Nielsen, K. O. (Univ. of Aarhus, Denmark). Nucl. Phys.; A204: No. 2, 371-384(1973).
The mean lifetimes of the 9.486 and 12.19 MeV levels in ^{32}S and ^{28}Si excited in the ^{31}P(p,α)^{28}Si and ^{27}Al(p,α)^{24}Mg reactions, respectively, have been measured by observing the axial blocking dips (shadows) of emitted α-particles with single crystals of GaP and Al as targets. The respective lifetimes are 80 and 100 as. These results are in good agreement with the values deduced from the yields of (p,α), (p,γ) and (α,γ) reactions, and thus provide a test of the blocking technique. (auth)

28972 BETA DECAY OF ^{22}F. Guratzsch, H.; Kabachenko, A. P.; Kuznetsov, I. V.; Siwek-Wilczynska, K.; Tarantin, N. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Nucl. Phys.; A205: No. 3, 574-580(1973).
The decay of ^{22}F was investigated with an on-line mass separator at a heavy-ion cyclotron. The maximum β-energy was determined to be 5.50 ± 0.15 MeV, contrary to a previously measured value of 11.2 ± 0.6 MeV. A half-life of 4.24 ± 0.08 sec was measured. A decay scheme is presented. (auth)

28973 WEAK POSITRON TRANSITION IN THE DECAY OF ^{30}P. Gourlay, J. Y.; Ledingham, K. W. D.; Fitzpatrick, M. L.; Lynch, J. G. (Univ. of Glasgow). J. Phys., A (London); 6: No. 3, 415-420(Mar 1973).
The weak positron branch in the decay of ^{30}P has been detected by using both gas flow and pneumatic transfer techniques in conjunction with a Ge(Li) detector. The log ft value for the transition to the first excited state of ^{30}Si has been found to be (5.66 ± 0.04), at variance with the previous experimental value and considerably different from the value calculated by Engelbertink and Brussaard (Nucl. Phys.; 76: 442–8(1966)). It has been shown that an increase in the $d_{\frac{3}{2}}$ mixing in the ^{30}P and ^{30}Si nuclear states is required to explain this result. (auth)

28974 PRODUCTION OF NEW NEUTRON-RICH LIGHT NUCLEI IN HIGH-ENERGY REACTIONS. Klapisch, R.; Poskanzer, A. M.; Prieels, R.; Roeckl, E.; Rigaud, C.; Thibault, C. (CNRS, Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 171 (1972).
New nuclei having half-lives as small as 9.0 msec and cross sections as small as 200 nanbarns were detected in p + U reactions at 24 GeV. The results of measurements of half-lives, masses, and decay modes are given for ^{27}Na, ^{28}Na, ^{29}Na, ^{30}Na, ^{31}Na, and ^{32}Na. (FR)

28975 DE-EXCITATION γ RAYS FOLLOWING PHOTODISINTEGRATION OF ^{28}Si. Thomson, J. E. M.; Champion, N. D.; Stewart, R. J. J.; Thompson, M. N. (Univ. of Melbourne, Parkville, Australia). Aust. J. Phys.; 25: No. 6, 669-672(Dec 1972).
Integrated cross sections for the population of excited states of ^{27}Al and ^{27}Si following photodisintegration of ^{28}Si are presented. Consistency with particle pickup reactions is claimed as evidence of the single-particle nature of the photonuclear reaction in the giant resonance region. (auth)

28976 (d,^{6}Li) REACTION ON ^{40}Ca, ^{39}K, ^{27}Al, AND ^{26}Mg. Donovan, R. L. College Station, TX; Texas A and M Univ. (1972). 88p. University Microfilms Order No. 73-3524.
Thesis (Ph.D.).
The (d,^{6}Li) reaction has been studied for targets of ^{40}Ca, ^{39}K, ^{27}Al, and ^{26}Mg at an incident energy of 50 MeV. Excitation of the ground state and lowest-lying 2^+ and 4^+ states is observed in ^{36}Ar and ^{22}Ne as well as excitation of a 0^+ state in ^{36}Ar at 5.2 MeV. It was noted that the cross section for excitation of the ^{35}Cl($\frac{3}{2}^+$) state is very similar to that for excitation of the ^{36}Ar(0^+) ground state in both magnitude and shape. It was also noted that the shapes of the cross sections for excitation of the ^{35}Cl($\frac{1}{2}^+$) and ^{35}Cl($\frac{3}{2}^+$) states are much like that for excitation of the ^{36}Ar(2^+) state and that their magnitudes sum to very nearly that of the Ar cross section and a possible interpretation presented. No such correspondence is observed between the ^{22}Ne and ^{23}Na cross sections. A zero-range DWBA analysis was attempted and the results are presented. The DWBA, as used, was shown to be inadequate to describe the reaction. (Diss. Abstr. Int., B)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 27693, 28938, 28950, 28955, 28964, 28976, 29004, 29019, 29034, 29053, 29054, 29057–29060, 29067, 29181, 29242, and 29261.

28977 (KFTI-71-28) PROTON STICKING PROBABILITY FOR THE STABLE NUCLEI FROM ^{40}Ca TO ^{54}Cr. Mishchenko, V. M.; Timoshevskii, G. F.; Storizhko, V. E. (Akademiya Nauk Ukrainskoi SSR, Kharkov. Fiziko-Tekhnicheskii Institut). 1971. 26p. (In Russian). INIS.
Proton sticking probablities were calculated for stable nuclei from ^{40}Ca to ^{54}Cr over the proton energy interval from 2 to 10 MeV in steps of 0.5 MeV. Calculations were performed on the M-220 computer in accordance with the optical model of the nucleus without allowing for spin–orbit interaction. The results of the calculations are tabulated. (tr-auth)

28978 TOTAL REACTION CROSS-SECTIONS FOR PIONS ON NUCLEI, AND NEUTRON DENSITY DISTRIBUTIONS. Allardyce, B. W. (Science Research Council, Chilton, Eng.); Batty, C. J.; Baugh, D. J.; Friedman, E.; Heymann, G.; Cage, M.; Pyle, G. J.; Squier, G. T. A.; Clough, A. S.; Cox, J.; Jackson, D. F.; Murugesu, S.; Rajaratnam, V. J. Phys. (Paris), Colloq.; No. 5, 157(1972).
The total reaction cross sections for π^+ and π^--mesons on C, Al, Ca, Ni, Sn, Ho and Pb at energies in the range from 0.5 to 2.0 GeV were measured, but are not listed in this paper. (FR)

28979 γ-DECAY OF ^{42}Sc AND ^{42}Ti. Hartmann, R.; Grawe, H.; Kaendler, K. (Univ., Freiburg i. B.). Nucl. Phys., A; A203: No. 2, 401-413(1973).
The lifetimes of the excited states at 0.61, 1.59 and 1.89 MeV in ^{42}Sc were measured by the DSAM in the reaction ^{40}Ca(^{3}He,pγ)^{42}Sc and found to be 140 ± 40, 90 ± 45 and 60 ± 30 fs, respectively. By n-γ coincidence and n-γ-γ triple coincidence measurements in the reaction ^{40}Ca(^{3}He,nγ)^{42}Ti the γ-decay of ^{42}Ti levels up to E_x = 3.75

MeV has been investigated. For the states at 1.55, 2.39 and 2.67 MeV the lifetimes 560 ± 160, 310 ± 180 and ≥1600 fs have been found, respectively. (auth)

28980 BETA-DECAY OF ^{32}Cl AND ^{40}Sc. Detraz, C. (Institut de Physique Nucleaire, Orsay, France); Zaidins, C. S.; Frantsvog, D. J.; Wilson, R. L.; Kunselman, A. R. Nucl. Phys., A; A203: No. 2, 414-420(1973).

The β^+ decays of ^{32}Cl and ^{40}Sc have been investigated with a rabbit system. New β branches and γ-lines are reported. Branching ratios and log ft values are determined. The 6.66 MeV state of ^{32}S is shown to have $J^\pi = 1^+$ or 2^+. (auth)

28981 EVIDENCE FOR TWO-STEP PROCESSES IN REACTIONS WITH SPHERICAL NUCLEI. Nelson, R. O. (North Carolina State Univ., Raleigh); Roberson, N. R. Phys. Lett., B; 43B: No. 5, 389-390(5 Mar 1973).

Experimental evidence for two-step processes in reactions with spherical nuclei is obtained from a study of ^{54}Fe(p,d)^{53}Fe angular distributions for low-lying $\frac{3}{2}^-$ and $\frac{11}{2}^-$ states. Predictions of the coupled-channel Born approximation give excellent agreement with the data. (auth)

28982 SYSTEMATICS OF (p,p′) AND (p,α) SPECTRA FROM 14 MeV PROTON BOMBARDMENT OF MEDIUM-A TARGETS. Sprinzak, A.; Kennedy, A. J.; Pacer, J. C.; Wiley, J.; Porile, N. T. (Purdue Univ., Lafayette, IN). Nucl. Phys., A; A203: No. 2, 280-294(1973).

Differential cross sections have been measured between 30° and 150° for the (p,p′) and (p,α) reactions induced by 14 MeV protons in the following targets: ^{55}Mn, ^{56}Fe, ^{58}Ni, ^{59}Co, ^{62}Ni, ^{63}Cu and ^{64}Zn. The results have been compared with the spin-dependent statistical theory and good agreement was obtained for the (p,α) reactions with a level density parameter $a = (0.138 \pm 0.008)A$ MeV^{-1}. This value is substantially lower than that obtained in a spin-independent analysis of the same data. The agreement of the (p,p′) spectra with theory is poor and it is found that a 15–40% contribution from precompound emission is required. The emission of low-energy protons from the (p,np) reaction was observed in all cases and comparison of the cross sections with those of the corresponding (p,n) reactions yields information on the competition between γ-ray and proton emission. (auth)

28983 RADIATIVE CAPTURE OF FAST PROTONS BY MEDIUM-MASS NUCLEI. Drake, D. M. (Los Alamos Scientific Lab., NM); Whetstone, S. L.; Halpern, I. Nucl. Phys., A; A203: No. 2, 257-279(1973).

High-energy photon spectra were obtained with moderate resolution for a number of neighboring nuclei: ^{56}Fe, ^{59}Co, ^{58}Ni, ^{60}Ni, ^{63}Cu and ^{64}Zn in bombardments with protons (8 to 22 MeV). The shapes, magnitudes and energy dependence of the observed spectra are found to be consistent in most of their essential features with the implications of the semidirect model for fast nucleon capture. (auth)

28984 ELECTROMAGNETIC PROPERTIES OF LEVELS IN ^{55}Mn. Hichwa, B. P.; Lawson, J. C.; Alexander, L. A.; Chagnon, P. R. (Univ. of Notre Dame, IN). Nucl. Phys.; A202: No. 2, 364-376(1973).

Excited levels of ^{55}Mn were produced by the reaction ^{52}Cr(α,p) at 10.5 and 11.1 MeV beam energy. A series of γ-ray measurements was made, all in coincidence with protons detected near 180°. A Ge(Li) γ-ray detector was used at 4 angles, and extensive angular-correlation measurements were made with an array of NaI(Tl) detectors. Excitation energies of 25 levels up to 3161 keV were determined, including a new level at 2215 keV. Only the level at 2285 keV and the $\frac{1}{2}^-$ state near 1290 keV were not observed in this range. From Doppler-shift attenuations, the mean lifetimes of 14 levels up to 2565 keV were deduced. Branching ratios and multipole mixing ratios were obtained for most of these levels. The following spin assignments were determined: 1530 keV, $J = \frac{3}{2}$; 1885 keV, $J = \frac{7}{2}$ or $\frac{5}{2}$; 2565 keV, $J = \frac{3}{2}$. Reduced transition probabilities, B(M1) and B(E2), of many transitions were calculated from these experimental results and are compared with the available theoretical values. (auth)

28985 (^{3}He,p) REACTIONS ON ^{54,56,58}Fe. Caldwell, T. (Univ. of Pennsylvania, Philadelphia); Nathan, O.; Hansen, O.; Bork, H. Nucl. Phys.; A202: No. 2, 225-240(1973).

The (^{3}He,p) reactions on targets of ^{54}Fe, ^{56}Fe and ^{58}Fe have been studied at a bombarding energy of 15.08 MeV. The angular distributions of the outgoing protons were measured from 3.75° to 86.25° by means of a multiangle magnetic spectrograph. The energy resolution was about 28 keV. A common, absolute cross-section scale was established from data obtained with a target containing equal amounts of the three Fe isotopes. Thirty-eight excited states were observed in ^{56}Co below 6.6 MeV of excitation, forty excited states were observed in ^{58}Co below 5.8 MeV and eighteen excited states were observed in ^{60}Co below 4.7 MeV. Empirical rules were used to assign L and J^π for a large number of final states in the three doubly odd Co nuclei. The possible fragmentation of the ground-state isobaric-analogue strength in ^{56}Co is discussed on the basis of (^{3}He,p) and (t,p) cross-section data. (auth)

28986 COLLECTIVE-MODEL ANALYSIS OF THE INELASTIC SCATTERING OF 53 AND 33 MeV HELIONS BY ^{56}Fe. Marchese, C. J.; Clarke, N. M.; Griffiths, R. J. (King's Coll., London). Nucl. Phys., A; A202: No. 2, 421-432.

Inelastic scattering of helions to the strongly excited states of ^{56}Fe have been measured at 53.4 and 33.45 MeV. Analyses in terms of the collective vibrational model using both DWBA and the SCA coupled-channel description examine the features of the reaction mechanism. The effects of optical-potential ambiguities, one- and two-phonon characteristics and multiple and direct excitations are discussed. (auth)

28987 AMBIGUITIES IN SPECTROSCOPIC FACTORS DEDUCED FROM A DWBA ANALYSIS OF THE (^{16}O,^{15}N) REACTION. Bechetti, F. D. (Univ. of California); Christensen, P. R.; Manko, V. I.; Nickles, R. J. Phys. Lett.; 43B: No. 4, 279-283(19 Feb 1973).

The spectroscopic factors deduced from a finite-range DWBA analysis of the (^{16}O,^{15}N) reaction show systematic discrepancies with those obtained from (τ,d), (α,t) and (d,n) reactions depending on whether $j = l + \frac{1}{2}$ or $j = l - \frac{1}{2}$. The results depend sensitively on the selection rules used, however. (auth)

28988 ISOTOPIC EFFECT IN NUCLEAR REACTIONS WITH HIGH ENERGY PARTICLES. Bogatin, V. I.; Bondarev, V. K.; Litvin, V. F.; Lozhkin, O. V.; Perfilov, N. A.; Yakovlev, Yu. P. Yadern. Fiz.; 17: No. 1, 9-12(Jan 1973). (In Russian).

The ratio of hydrogen and helium isotope yields in 660-MeV proton interaction with nuclei of separated isotopes of nickel (^{58}Ni and ^{64}Ni) and tin (^{112}Sn and ^{124}Sn) has been found with the help of a telescope of semiconductor detectors dE/dx and E. A strong isotopic effect has been found: experimental data point to a considerable difference of ^{3}H and ^{3}He production cross sections for the indicated isotopes of the target: the ratio of ^{3}H and ^{3}He yields from ^{58}Ni and ^{64}Ni are 0.77 and 1.82 respectively, and from ^{112}Sn and ^{124}Sn −0.89 and 2.08 for the measured energy range of particles. (auth)

28989 COUPLED CHANNEL CALCULATION FOR ELASTIC SCATTERING OF DEUTERONS ON ^{40}Ca. Mukherjee, S. N. (Banaras Hindu Univ., India). pp 93-97 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28990 ANGULAR MOMENTUM EFFECTS IN THE ELASTIC SCATTERING OF ^{16}O FROM CALCIUM ISOTOPES: A CALCULATION. Mehta, M. K. (Bhabha Atomic Research Centre, Trombay, India). pp 99-105 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28991 DEFORMATION-PRODUCING TENDENCY OF THE T = 1 INTERACTION. Sharma, S. K.; Bhatt, K. H. (Physical Research Lab., Ahmedabad, India). pp 305-309 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28992 LIFETIME AND MAGNETIC MOMENT OF 68 keV STATE IN ^{44}Sc. Gupta, D. K.; Sanwal, D. N.; Rao, G. N. (Indian Inst. of Tech., Kanpur). pp 349-352 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28993 DECAY OF ^{48}Sc. Singh, H.; Tikku, V. K.; Sethi, B. (Saha Inst. of Nuclear Physics, Calcutta). pp 451-454 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

28994 MEASUREMENTS OF ATOM MASSES IN THE REGION FROM TITANIUM TO IRON. Demirkhanov, R. A.; Dorokhov, V. V.; Dzkuya, M. I. (State Committee on Atomic Energy, Sukhumi, USSR). pp 210-220 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th International Conference on Atomic Masses and Fundamental Constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Discrepancies in nuclear mass values in the region $45 < A < 58$ were considered; and, as a result, the values were remeasured with additional control measurements of high accuracy, independent from each other, measuring each mass several times and checking the obtained results for consistency in each case to exclude systematic errors. The methods and techniques used to evaluate the masses of titanium, vanadium, chromium, manganese and iron isotopes are given. The results are tabulated and compared with earlier mass spectroscopic measurements. There are certain serious discrepancies that cannot be explained by statistical errors. (UK)

28995 PHOTONEUTRON CROSS SECTION OF ^{45}Sc. Sambell, R. H.; Spicer, B. M. (Univ. of Melbourne, Parkville, Australia). Nucl. Phys.; A205: No. 1, 139-144(1973).

The photoneutron cross section of ^{45}Sc has been measured from threshold to 25 MeV using bremsstrahlung and direct neutron detection. The cross section is found to exhibit a large width of approximately 8 MeV and this is interpreted in terms of the Danos hydrodynamic model for the giant resonance of deformed nuclei. The integrated cross section to 25 MeV is 158 ± 24 MeV · mb. (auth)

28996 DOUBLE GAMMA DECAY IN ^{40}Ca. Beardsworth, E. Brunswick, NJ; Rutgers — The State Univ. (1972). 125p. University Microfilms Order No. 73-4718.

Thesis (Ph. D.).

A positive indication of double gamma decay in ^{40}Ca has been observed. A branching ratio $\Gamma_{\gamma\gamma}/\Gamma = (3.3 \pm 0.5) \times 10^{-4}$ is reported for the decay of the 3.35 MeV 0^+ state. The state was preferentially populated by the (p,p′) reaction at a bombarding energy of 5.08 MeV, through a resonance in the compound nucleus ^{41}Sc. Recoil particles were detected in an annular detector at 180°, and gammas were detected in two 5 × 5″ NaI (Tl) detectors at 45° and 135° with respect to the beam axis. Triple time coincidence was demanded of the three radiations, and gamma energy signals were event-recorded, together with coincidence information permitting subsequent generation of two-dimensional energy spectra (E_{γ_1} vs. E_{γ_2}) for real, correlated random, and random coincidences. The distribution of double gamma events was analyzed by the maximum likelihood technique and was found to be consistent with the assumption of (E1,E1) multipolarities. A variety of background processes were considered, but none were found likely to account for the observed spectrum. A brief historical review is given, along with a summary of previous experiments which sought to observe double gamma decay in ^{40}Ca and other nuclei. Existing theories for the process are examined. (Diss. Abstr. Int., B)

28997 (p,t) REACTION ON MEDIUM WEIGHT NUCLEI AT E_p = 27 MeV. Shepard, J. R. Boulder, CO; Univ. of Colorado (1972). 230p. University Microfilms Order No. 73-1827.

Thesis (Ph. D.).

Angular distributions were measured for several transitions in each of the ^{26}Mg, ^{50}Cr, ^{58}Ni, ^{70}Ge, and ^{90}Zr (p,t) reactions at E_p = 27 MeV. These data were compared with distorted wave Born approximation (DWBA) calculations for the purpose of examining difficulties with the DWBA description of the (p,t) reaction. The exact nature of these difficulties was related to the inappropriateness of assumptions basic to the DWBA. Through comparison of data with theoretical compound nuclear cross sections, the DWBA assumption of the dominance of direct processes in the reaction mechanism was found in most instances not to be violated by the presence of compound-nuclear effects. However certain weak transitions in the ^{26}Mg (p,t) reaction did exhibit pronounced compound-nuclear character. Use of simplified wave functions in computing the (p,t) form factor was observed to have little effect on the shapes of the theoretical DWBA angular distributions. The magnitudes of the cross sections, both relative and absolute, were found to depend critically on the choice of nuclear wave functions. Optical model parameter sensitivities of the DWBA calculations were observed and attributed to optical model parameter ambiguities not resolved by elastic scattering experiments. The cross sections for multi-step processes, ignored in the DWBA, were found to be substantial relative to the experimental cross sections. A modification of the standard DWBA was also proposed and shown in several cases to aid in reproduction of the experimental data by the DWBA. (Diss. Abstr. Int., B)

28998 HALF-LIFE OF THE GROUND STATE OF ^{53}Co. Kochan, S.; Rosner, B.; Tserruya, I.; Kalish, R. (Technion-Israel Inst. of Tech., Haifa). Nucl. Phys.; A204: No. 1, 185-195(1973).

The half-life of ^{53}Co(g.s.) was measured by observing its positron emission following the ^{39}K(^{16}O,2n) reaction induced by a chopped ^{16}O beam. The contributions to the half-life of positrons from competing reaction products were considered. The final spin distribution and the isomeric ratio values for ^{53m}Co/^{53}Co(g.s.) and ^{53m}Fe/^{53}Fe(g.s.) were calculated by the spin-dependent nuclear evaporation model and found to be different, the former much smaller than the latter. The ^{53m}Fe/^{53}Fe(g.s.) isomeric ratios were measured for ^{39}K + ^{16}O as well as for ^{40}Ca + ^{16}O reactions and were found to be in agreement with the above theoretical prediction. On the basis of the smallness of the calculated ^{53m}Co/^{53}Co(g.s.) ratio, the half-life of ^{53}Co(g.s.) was determined to be $T_{\frac{1}{2}} = 262 \pm 25$ ms. (auth)

28999 SEARCHING FOR BRANCHING IN THE β^+ DECAY OF THE ^{42}Sc GROUND STATE. Burcham, W. E. (Univ. of Birmingham, Eng.); Murray, G.; Robinson, D. C.; Freeman, J. M.; Jenkin, J. G. Proc. Roy. Soc. Edinburgh, Sect. A; 70: 39-45(1972).

A search was made for branching to the 1.84 MeV state of ^{42}Ca in the ^{42}Sc ground state decay. This was found to be less than 0.02%. The branching has a negligible effect on the calculation of the vector coupling constant G_v for the weak interaction from the ^{42}Sc decay. (auth)

29000 PROTON ANGULAR DISTRIBUTIONS FROM THE ^{40}Ca(e,e′p) REACTION. Campos Venuti, G. (Istituto Superiore di Sanita, Rome); Cortellessa, G.; Farchi, G.; Frullani, S.; Giordano, R.; Salvadori, P.; Takamatsu, K.; Capitani, G. P.; de Sanctis, E. Nucl. Phys.; A205: No. 3, 628-640(1973).

Angular distributions of protons emitted in the (e,e′p) reaction on ^{40}Ca at an incident electron energy of 710 MeV and for missing energies E_M = 39 and 81 MeV are presented. The interpretation of these angular distributions in terms of momentum distributions for the struck protons in the original target nucleus indicates $l \neq 0$ protons at E_M = 39 MeV and $l = 0$ protons at E_M = 81 MeV. Finally (p,2p) and (e,e′p) results in calcium are compared. (auth)

29001 ^{56}Fe(n,p)^{56}Mn AND ^{27}Al(n,α)^{24}Na CROSS SECTIONS AT 14.78 MeV. Robertson, J. C.; Audric, B. N.; Kolkowski, P. (National Physical Lab., Teddington, Eng.). J. Nucl. Energy; 27: No. 3, 139-149(Mar 1973).

The ^{56}Fe(n,p)^{56}Mn and ^{27}Al(n,α)^{24}Na cross sections were measured at the average energy of 14.78 MeV with an energy width of 200 keV. Aluminium and iron samples in the form of foils were irradiated in an accurately known neutron flux and the resulting ^{56}Mn and ^{24}Na activities determined using absolute $4\pi\beta-\gamma$ counting techniques. The flux was determined using a recoil proton monitor to an accuracy of ±2.1%. The values obtained were 109.8 ± 2.9 mb and 115.5 ± 3 mb where the errors were obtained by adding the systematic error in determining the neutron flux linearly to the random error calculated at the 99% confidence level in determining and ^{56}Mn and ^{24}Na activities. (auth)

29002 STUDY OF NUCLEAR STRUCTURE IN ^{59}Ni FROM THE (d,p) REACTION ON ^{58}Ni. Chowdhury, M. S.; Sen Gupta, H. M. (Univ. of Dacca). Nucl. Phys.; A205: No. 3, 454-474 (1973).

Level structure in ^{59}Ni is studied from the (d,p) reaction in ^{58}Ni using the Aldermaston tandem Van de Graaff accelerator and the multichannel magnetic spectrograph. Angular distributions of protons are measured over the angular range 5 to 175° up to an excitation of ≈8 MeV, and absolute cross sections are measured. The data are analyzed in terms of the finite-range DWBA theory of direct reactions and spins, parities and spectroscopic factors are deduced for various levels. The summed spectroscopic factors and the single-quasiparticle energies of the shell-model states are obtained. Properties of the low-lying levels in ^{59}Ni are compared with predictions based on exact shell-model calculations. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 28913, 28950, 28980, 28982, 28983, 28987, 28988, 28997, 29002, 29008, 29033–29035, 29037, 29040, 29056, 29067, 29090, 29158, 29222, 29259, and 29412.

29003 (BARC-633) ANNUAL REPORT OF THE NUCLEAR PHYSICS DIVISION, 1971. Satya Murthy, N. S.; Ramamurthy,

V. S. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 156p. Dep. NTIS (U. S. Sales Only).

ALPHA PARTICLES—scattering by implanted heavy ions, energy spectra from, (E)
—reactions (α,f) with gold-197, barrier height and shell correction for, (T)
AMMONIA—neutron scattering from liquid, analysis of data on
AMMONIUM SULFAMATES—structure of, neutron diffraction study of
AMMONIUM TARTRATES—crystal structure analysis of piezoelectric
ARSENIC-73—energy levels from proton resonances in germanium-72, spin–parity assignments and widths for, (E)
BERYLLIUM—phonon dispersion and frequency distribution in
—phonon shape calculations for filter-detector spectrometer
CALCIUM OXIDES—phonon dispersion curves of, density of states from optical
CARBON-12—meson reactions (π^-,nn) with, neutron energy spectrum from, (T)
COBALT ALLOYS—Co–Fe–Ge, iron-57 Moessbauer spectrum of CoFeGe
COBALT FERRATES—$CoFe_2O_4$–$ZnFe_2O_4$, structure and magnetic properties of, neutron-diffraction and Moessbauer study of
COPPER-65—energy levels from proton resonances in nickel-64, Coulomb displacement energies for, (E)
CRYSTALLOGRAPHY—lattice parameter determination from Weissenberg photographs
—Bragg angle from zero-layer Weissenberg photographs, effects of misalignment on
FERMIUM-254—fission of stochastic-theory calculations of fragment mass distributions in low-energy, (T)
FERMIUM-258—fission of stochastic-theory calculations of fragment mass distributions in low-energy, (T)
FLUORINE-19—alpha reactions at 3.96 to 4.55 MeV, excitation functions for gamma production in, (E)
GERMANIUM-72—proton reactions (p,p'e) at 3.30 to 4.70 MeV, excitation function for, (E)
GOLD-197—alpha fission of, barrier height and shell correction for, (T)
HYDROQUINONE—tetrachloro-, molecular structure of
INSTRUMENTS—research at Bhabha Atomic Research Center, 1971, (E/T)
IONS—implantation in aluminum, equipment and studies at Bhabha Atomic Research Center, Bombay, 1971
IRON ISOTOPES Fe-57—Moessbauer spectrum in CoFeGe alloy
IRON OXIDES Fe_3O_4—magnon profiles in, from polarized neutron diffraction
KRYPTON ISOTOPES—energy-level transitions from bromine (p,n) reactions, K-conversion coefficients and multipolarities for, (E)
LITHIUM-6—nuclear structure from meson (π) absorption, (T)
—meson reactions (π^-,nn), recoil momentum distribution from, (T)
LITHIUM-7—clustering in, from (p,pt) reaction, (T)
—proton reactions (p,pt) at 55 to 156 MeV, DWIA calculations of angular correlations in, (T)
LYSINE—structure of monohydrochloride dihydrate of L-neutron-diffraction study of
MANGANESE FERRATES—magnon dispersion curve in $MnFe_2O_4$, effective intersublattice exchange constant from acoustic
METHANE—neutron multiple scattering spectra of liquid
NEUTRON-DIFFRACTION ANALYSIS—developments in
NEUTRON SPECTROMETERS—resonant flipper for polarized, transistorized
—modification of rotating-crystal
NEUTRON SPECTROSCOPY—grating misalignment effect
NICKEL-64—proton elastic scattering at 3.150 to 4.025 MeV, excitation functions for, (E)
NUCLEAR REACTIONS—yield of (π^-,NN), effect of 2p pionic orbit on, (T)
NUCLEI, HEAVY—shell correction for A = 200 to 244 alternative method to Strutinsky procedure for finding, (T)
NUCLEI, INTERMEDIATE—energy levels of A = 46 to 72, Hartree–Fock–Bogolyubov calculations of, (T)
OXYGEN-16—scattering by calcium isotopes, angular momentum effects inelastic, (T)
PEPTIDES—crystal structure of glycine-L-threonine dihydrate
POTASSIUM ACID PHOSPHATES—neutron scattering spectrum of KH_2PO_4
POTASSIUM MANGANESE FLUORIDES—neutron inelastic scattering from paramagnetic, analysis of data on
REACTORS—research at Bhabha Atomic Research Center, 1971, (E/T)
SEISMOLOGY—research at Bhabha Atomic Research Center, 1971, (E/T)
SILICON—phonon shape calculations for filter-detector spectrometer
SOLID STATE PHYSICS—research program of Bhabha Center (India) on
STEARATES—sodium salt, neutron scattering spectrum
URANIUM-235—neutron fission of, evidence for four fragments in thermal, (E)
—neutron fission at, angle-correlated alpha energy spectra from thermal, (E)
VAN DE GRAAFF ACCELERATORS—operation of Bhabha Atomic Research Center, 1971
—experimental facility at Bhabha Atomic Research Center, description and performance of neutron time-of-flight spectrometers

29004 (COO-3496-14) LEVEL DENSITIES FROM SPECTRA OF DIFFERENT REACTIONS POPULATING THE SAME NUCLEUS. Lu, C. C.; Vaz, L. C.; Huizenga, J. R. (Rochester Univ., N. Y.). 1971. 64p. Dep. NTIS $5.25.

Level densities of ^{56}Fe, ^{59}Co, ^{60}Ni, ^{62}Ni, ^{63}Cu, and ^{65}Cu were determined from analyses of several charged-particle spectra populating the same residual nucleus. Experimental spectra are reported for the following reactions: $^{56}Fe(\alpha,\alpha')^{56}Fe$, $^{59}Co(p,\alpha)^{56}Fe$, $^{59}Co(p,p')^{59}Co$, $^{59}Co(\alpha,\alpha')^{59}Co$, $^{56}Fe(\alpha,p)^{59}Co$, $^{62}Ni(p,\alpha)^{59}Co$, $^{60}Ni(\alpha,\alpha')^{60}Ni$, $^{63}Cu(p,\alpha)^{60}Ni$, $^{62}Ni(p,p')^{62}Ni$, $^{62}Ni(\alpha,\alpha')^{62}Ni$, $^{59}Co(\alpha,p)^{62}Ni$, $^{65}Cu(p,\alpha)^{62}Ni$, $^{63}Cu(p,p')^{63}Cu$, $^{63}Cu(\alpha,\alpha')^{63}Cu$, $^{60}Ni(\alpha,p)^{63}Cu$, $^{65}Cu(p,p')^{65}Cu$, $^{65}Cu(\alpha,\alpha')^{65}Cu$ and $^{62}Ni(\alpha,p)^{65}Cu$. Each of these experimental spectra is analyzed with an exact theory giving the angle- and energy-dependent differential cross sections for compound-nucleus reactions including explicitly the angular momentum. From these analyses the following Fermi-gas level-density parameters were determined: ^{56}Fe, a = 5.7 MeV^{-1}, Δ = 0.7 MeV; ^{59}Co, a = 6.2 MeV^{-1}, Δ = −0.8 MeV; ^{60}Ni, a = 6.4 MeV^{-1}, Δ = 1.3 MeV; ^{62}Ni, a = 6.4 MeV^{-1}, Δ = 0.5 MeV; ^{63}Cu, a = 6.8 MeV^{-1}, Δ = −0.5 MeV; and ^{65}Cu, a = 6.6 MeV^{-1} and Δ = −0.5 MeV. All of the spectra were analyzed also with the conventional slope technique, which utilizes the Weisskopf expression for the differential cross sections. The results from such an analysis depends on the form of the preexponential term in the level-density formula, and may give sizeable errors in the Fermi-gas level-density parameter, a. A number of theoretical spectra were computed with the exact theory, which explicitly includes angular momentum; and these spectra were analyzed with the conventional methods to illustrate the errors introduced when angular momentum is not treated properly for such reactions. An estimate of precompound proton emission is made for several (p,p') reactions. (19 figures, 2 tables) (auth)

29005 (IS-T-563) BETA DECAY OF GASEOUS FISSION PRODUCTS. Halbig, J. K. (Ames Lab., Iowa). Feb 1973. Contract W-7405-eng-82. 155p. Dep. NTIS $9.75.
Thesis.

The development of a Bartlett-type $\pi\sqrt{2}$ double-focusing beta-ray spectrometer for operation on-line to the TRISTAN isotope separator at Ames Laboratory is described. Improvements in the magnetic field control system previously used in this spectrometer are reported. The improvements include the implementation of a six-band programmable digital field selector and a new field stabilization system which has settling times much smaller than those of the original system. The adaption of a third generation moving tape collector for use in the spectrometer is discussed. Interesting features include use of a special "split" aluminized Mylar tape for ion-beam stabilization inside the spectrometer, tape supply reels which hold approximately five times as much tape as reels used in previous designs, and a tape transport system which allows rapid movement of tape. The investigations carried out with the spectrometer are, briefly, as follows: The beta spectra of ^{85m}Kr, ^{87}Kr, ^{88}Rb, and ^{91}Sr were studied to determine the beta end-point energies and the branchings to the ground state. Internal conversion electron intensities were measured for transitions in the decays of ^{85m}Kr, ^{88}Kr, ^{90}Kr, ^{91}Kr, ^{91}Rb, ^{91}Sr, and ^{92}Kr. (auth)

29006 $^{65}Cu(p,t)^{63}Cu$ REACTION AND THE STRUCTURE OF ^{63}Cu. Markham, R. G.; Fulbright, H. W. (Univ. of Rochester, NY). Nucl. Phys., A; A203: No. 2, 244-256(1973).

The $^{65}Cu(p,t)^{63}Cu$ reaction has been studied with 18.0 and 19.5 MeV protons. The states in ^{63}Cu at 1.547 and 2.498 MeV are each assigned $J^\pi = 3/2^-$ on the basis of angular distributions indicating mixed L = 0 and L = 2 transfer. Relative cross sections for L = 2 transfer to the low-lying states are compared with predictions of the shell model and particle-core model. (auth)

29007 TWO-NUCLEON PICK-UP FROM SPIN-½ TARGETS. II. ^{89}Y. Peterson, R. J.; Rudolph, H. (Univ. of Colorado, Boulder). Nucl. Phys.; A202: No. 2, 335-352(1973).

The angular distributions for the ^{89}Y(p,t), (p,τ), and (d,α) reactions are compared to DWBA predictions and to the data for the ^{90}Zr(p,t) and (d,α) reactions. Several new spins are assigned to levels of ^{87}Y. A weak coupling model is tested by the comparison between the reactions on ^{89}Y and ^{90}Zr, and found to fail. The (d,α) reaction is found to populate strongly levels at excitation energies of 2.70 MeV and 3.07 MeV in ^{87}Sr, corresponding roughly in Q-value and strength to states formed in the ^{88}Sr(d,α)^{86}Rb reaction. (auth)

29008 MASSES OF ^{36}K, ^{80,82}Rb FROM THRESHOLDS FOR (p,n) REACTIONS AND COULOMB ENERGY SYSTEMATICS NEAR A = 36. Jaffe, A. A. (Univ. of North Carolina, Chapel Hill); Bissinger, G. A.; Shafroth, S. M.; White, T. A.; Dzubay, T. G.; Everling, F.; Miller, D. W.; Outlaw, D. A. (Univ. of North Carolina, Chapel Hill). pp 236-244 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London, Plenum Press (1972).

From 4th International Conference on Atomic Masses and Fundamental Constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The methods and techniques which were employed for the measurement of the masses of ^{36}K, ^{80,82}Rb from thresholds for (p,n) reactions and Coulomb energy systematics near A = 36 are reported. The measured half-life of ^{80}Rb was 29 ± 2 sec; and the threshold for the ^{80}Kr(p,n)^{80}Rb reaction was found to be 6,566 ± 20 keV, which corresponds to a Q value of −6,484 ± 20 keV and a mass excess for ^{80}Rb of −72,195 ± 21 keV. The threshold for the ^{82}Kr(p,n)^{82}Rb reaction was 5,222 ± 20 keV, which leads to Q = −5,159 ± 20 keV and a mass excess for ^{82}Rb of −76,215 ± 21 keV. The half-life of ^{82}Rb was measured as 80 ± 3 sec. Comparable values for the ^{36}Ar(p,n)^{36}K reaction were found to be threshold energy = 14,002 ± 24 keV, Q value = −13,618 ± 23 keV, mass excess of ^{36}K = −17,395 ± 23 keV and half-life of ^{36}K = 0.341 ± 0.006 sec. (UK)

29009 LEVEL STRUCTURE OF N = 49 NUCLEI UP TO AN EXCITATION ENERGY OF 13 MeV BY THE (p,d) REACTION. Taketani, H.; Adachi, M.; Ogawa, M.; Ashibe, K. (Tokyo Inst. of Tech.). Nucl. Phys.; A204: No. 2, 385-411(1973).

Levels up to an excitation energy of 13 MeV in the N = 49 nuclei, ^{87}Sr, ^{89}Zr, ^{91}Mo, and ^{89}Y, were investigated by means of the (p,d) reaction. The incident proton energies were 52 and 53 MeV, and the outgoing deuterons were analyzed with a broad-range magnetic spectrometer. The experimental angular distributions were compared with DWBA calculations, and the l_n values and spectroscopic factors were deduced. A number of new levels including analog states were found. The extensive level structure obtained is qualitatively consistent with the concept that most of the levels are due to the fragmentation of the $1g_{9/2}$, $2p_{1/2}$, $2p_{3/2}$, and $1f_{5/2}$ neutron-hole strengths by isospin splitting and core-polarization effects. (12 figures, 7 tables) (auth)

29010 REACTION ^{64}Ni(p,p)^{64}Ni IN THE RANGE 3.150 TO 4.025 MeV. Gupta, S. K.; Kerekatte, S. S.; Mehta, M. K.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 7-11 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720211-(Vol. 14B).

29011 SPINS OF LOW LYING LEVELS IN ^{75}Se. Lal, B.; Sahai, B. (Tata Inst. of Fundamental Research, Bombay). pp 27-31 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720211-(Vol. 14B).

29012 ^{75}As AND THE CORE EXCITATION MODEL. Satyanarayana, G.; Seetaramanath, M. N.; Lakshminarayana, V. (Andhra Univ., Visakhapatnam, India). pp 311-315 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29013 HALF-LIFE MEASUREMENT OF THE 1291.6 keV LEVEL IN ^{59}Co. Chauhan, S. D.; Garg, R. K.; Pancholi, S. C.; Gupta, S. L.; Saha, N. K. (Univ. of Delhi). pp 323-327 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29014 DIRECTIONAL CORRELATION STUDIES IN ^{58}Co. Bajaj, M. M.; Kumar, A.; Soni, S. K.; Pancholi, S. C.; Gupta, S. L.; Saha, N. K. (Univ. of Delhi). pp 375-380 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29015 DETERMINATION OF CONVERSION COEFFICIENTS IN ^{75}As. Mallikarjuna Rao, B.; Venkata Ramaniah, K.; Venkata Reddy, K. (Andhra Univ., Waltair, India). pp 407-411 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720211-(Vol. 14B).

29016 CONVERSION ELECTRON STUDIES FOLLOWING THE ^{79,81}Br(p,n)^{79,81}Kr REACTIONS. Agarwal, Y. K.; Baba, C. V. K.; Betigeri, M. G.; Bharathi, S. M.; Lal, B.; Puttaswamy, N. G. (Bhabha Atomic Research Centre, Trombay, India). pp 413-419 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29017 MOESSBAUER PARITY EXPERIMENT ON ^{61}Ni AND THE DETERMINATION OF THE ^{61}Co GROUND STATE SPIN. Schmidt, K. P.; Coussement, R.; Langouche, G.; Lafaut, J. P. (Univ., Louvain, Belg.). Nucl. Phys.; A204: No. 2, 279-288 (1973).

In a β-γ coincidence experiment the resulting polarization of the daughter nucleus can be detected by Mössbauer spectroscopy. Using this polarization, an experiment to test parity violation in the allowed Gamow-Teller β-decay of ^{61}Co has been performed, which yields $0.7 \leq c'_A/c_A \leq 1.5$. From the sign of the asymmetry of the β-γ coincidence Mössbauer spectrum the spin of the ^{61}Co ground state is measured to be $J = 7/2$. (auth)

29018 MAGNETIC MOMENTS OF ISOMERIC STATES IN ^{66}Ga, ^{78}Br, AND ^{81}Br. Christiansen, J.; Heubes, P.; Ingwersen, H.; Johann, H. G.; Klinger, W.; Kreische, W.; Lampert, W.; Loeffler, W.; Schatz, G.; Witthuhn, W. (Univ., Erlangen, Ger.). Rev. Roum. Phys.; 17: No. 6, 751-755(1972).

Measurements of the g-factors of isomeric states in ^{66}Ga, ^{78}Br, and ^{81}Br are reported. The methods used were the time-differential method and the stroboscopic observation. Good agreement is obtained with calculations according to Noya et al. (Progr. Theor. Phys. Suppl., 8:33 (1958)). (LBS)

29019 STRUCTURE INFORMATION FROM (f−p) SHELL NUCLEI. Betigeri, M. G. (Bhabha Atomic Research Centre, Bombay). pp 93-122 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1−4, 1972. Bombay; Dept. of Atomic Energy (1972).

29020 PHOTOPROTONS FROM ZINC-64. Clark, G. E. Ames, IA; Iowa State Univ. (1972). 88p. University Microfilms Order No. 73-3868.

Thesis (Ph. D.).

An absolute cross section for the reaction ^{64}Zn(γ,p)^{63}Cu has been measured at four angles using 15 to 27 MeV bremsstrahlung from the Electron Prototype Accelerator at Los Alamos. Reaction strength was found in three regions of excitation energy. The strength at 16.5 MeV, with an isotropic angular distribution, is attributed to the main giant dipole resonance of the $T_< = 2$ states. The peak at 19 MeV, which exhibits the $\sin^2\theta$ distribution characteristic of direct dipole interactions, is assigned to the $T_> = 3$ giant resonance thereby resolving a controversy in the literature. The strength in the region near 22 MeV could be explained by the electric quadrupole interaction. The results were compared with recently published sum rules and estimates of the energy splitting of the isospin components. (auth)

29021 BETA-SPECTRA SHAPE FACTORS IN THE DECAY OF ^{140}La AND ^{72}Ga. Connor, R. D.; Goldman, T. J.; Fairweather, I. L. (Univ. of Manitoba, Winnipeg). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 67-74(1972).

The shape factors of the partial β-spectra of highest end-point

energy in the decay of ^{72}Ga and ^{140}La have been calculated and compared with the only previously reported determination of these quantities (Langer and Smith, Phys. Rev.; 119: 1308(1960)). For both isotopes the shape factor is consonant with the view that the B_{ij} matrix element controls the decay. Shape factor analysis alone is insufficient to determine the cause of the predominance of a particular matrix element. (auth)

29022 GAMMA-RAY DECAY SCHEMES FOR ^{89}Kr AND ^{89}Rb. Henry, E. A. Ames, IA; Iowa State Univ. (1972). 134p. University Microfilms Order No. 73-3890.

Thesis (Ph. D.).

A study of gamma-ray de-excitation following the beta decay of ^{89}Kr and ^{89}Rb produced by the TRISTAN on-line isotope separator is reported. Measurements of gamma-ray energies and intensities were made using Ge(Li) detectors. Level schemes have been constructed for ^{89}Rb and ^{89}Sr with the aid of gamma-gamma coincidence information, and beta branching was determined from equilibrium data and gamma-intensity balances. The excited levels of ^{89}Sr appear to be explained by single-particle states and the coupling of single-particle states to the vibration states of ^{88}Sr. The ^{89}Rb nucleus is shown to have a complex level scheme and will require further studies to clarify the picture of its nuclear structure. (Diss. Abstr. Int., B)

29023 PRODUCTION AND STUDY OF VERY NEUTRON DEFICIENT NUCLEI. Westgaard, L. (European Organization for Nuclear Research, Geneva). J. Phys. (Paris), Colloq.; No. 5, 170(1972).

Recent experimental results obtained by the ISOLDE group at CERN are presented. They concern the decay modes and half-lives of the ^{75}Rb, ^{76}Rb, ^{77}Rb, ^{113}Xe, ^{117}Cs, and ^{118}Cs isotopes. (FR)

29024 GAMMA TRANSITION IN ^{59}Ni FOLLOWING THE β^+ DECAY OF ^{59}Cu. Van Patter, D. M.; Rauch, F.; Seim, B. (Univ., Frankfurt am Main). Nucl. Phys.; A204: No. 1, 172-184(1973).

The γ-ray decay spectrum of 82 s ^{59}Cu produced by the ^{58}Ni(p,γ) ^{59}Cu reaction has been studied with a 40 cm^3 Ge(Li) detector. The number of γ-rays now known for this decay has more than doubled. Additional direct β^+ branches to the 1679.7($^5/_2^-$), 2414.8($^3/_2^-$) and 2681 keV states of ^{59}Ni have been identified with log ft values of 5.5, 5.5 and 6.0, respectively. A major change is the reassignment of the 1340.4 keV γ-ray to a 1679.7 → 339.3 keV transition. A limit of log ft ≥ 6.9 is given for the direct feeding of the 1337 ($^1/_2^-$) keV state, together with limits for direct population of other energetically available states. The new weak γ-ray branches found for the 878.0, 1301.5 and 1679.1 keV levels are in excellent agreement with the recent theoretical calculations of Glaudemans et al. (auth)

29025 ISOMERISM IN ^{69}Se. Preiss, I. L. (Rensselaer Polytechnic Inst., Troy, NY); LaBrecque, J. J.; Bakhru, H.; Morse, R. I. Nucl. Phys.; A205: No. 3, 619-627(1973).

Isomeric states of ^{69}Se were produced via the heavy-ion compound-nucleus process and from the positron decay of ^{69}Br, the former producing a high-spin state and the latter preferentially populating a low-spin state. Ge(Li) detectors as well as scintillation counting showed that the high-spin state decays with $T_{1/2}$ = 14.0 ± 1.0 min to levels in ^{69}As, giving rise to γ-rays of 116, 166 and 282 keV. The low-spin state decays predominantly to a state giving rise to a 145 keV γ-ray with $T_{1/2}$ = 1.8 ± 0.2 min. The beta end-point energy of both isomers is 5.2 ± 0.2 MeV. It is deduced that the high-spin state, assigned $J^\pi = {}^9/_2^+$, is the ground state; the isomeric state had $J^\pi = {}^3/_2^-$. The angular momentum inversion as compared to neutron-excess Se isotopes is attributed to Coriolis coupling to a deformed core as described by Malik and Scholz. (auth)

29026 MEASUREMENT OF ISOMERIC RATIOS FOR THERMAL NEUTRONS. Bak, H. I.; Kim, H. J.; Lee, C. J. Korean Nucl. Soc.; 4: No. 4, 340-344(Dec 1972). (In Korean).

Isomeric ratios were measured for the capture of thermal neutron by ^{79}Br, ^{80}Se, ^{103}Rh, ^{115}In and ^{133}Cs as well as those of epi-cadmium neutron by ^{79}Br, ^{80}Se and ^{133}Cs. The measurements were performed by analyzing decay curves obtained by γ-ray spectrometry after irradiation. The counting efficiency curve was determined by using the calibrated standard sources with overall uncertainties of about 1%. Isomeric ratios, given in σ high spin/(σ high spin + σ low spin), of ^{80,80m}Br, ^{81,81m}Se, ^{104,104m}Rh, ^{116,116m}In and ^{134,134m}Cs produced by thermal neutron activation were found to be 0.21 ± 0.01, 0.14 ± 0.02, 0.12 ± 0.02, 0.69 ± 0.07 and 0.058 ± 0.004, respectively. Those values of ^{80,80m}Br, ^{81,81m}Se, and ^{134,134m}Cs produced by epi-cadmium neutron were found to be 0.19 ± 0.02, 0.29 ± 0.02 and 0.074 ± 0.011, respectively. The experimental values obtained were compared with the theoretical values deduced from the statistical model. There were the general agreements between the theory and the experiment. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 27693, 28938, 28978, 28987, 28988, 29005, 29009, 29021, 29023, 29026, 29090, 29152, 29222, 29236, and 29259.

29027 (CONF-720221-(Vol. 14B)) PROCEEDINGS OF THE NUCLEAR PHYSICS AND SOLID STATE PHYSICS SYMPOSIUM, BOMBAY, FEBRUARY 1–4, 1972. Volume 14B. Nuclear Physics and Reactor Physics. (Department of Atomic Energy, Bombay (India). Physics Committee). 1972. 681p.

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972).

The papers in this proceeding are title listed in this issue of NSA. (CES)

For titles of individual papers see: 27645, 27690, 27691, 27767, 28354, 28398, 28402–28406, 28893–28897, 28907–28911, 28936–28945, 28963–28970, 28989–28993, 29010–29016, 29040–29049, 29086–29094, 29116–29119, 29142–29148, 29216–29233, 29376, 29411, 29412, 29760, 29761, and 29798–29802.

29028 (JINR–P6-6861) DELAYED PROTONS AND STRENGTH FUNCTIONS OF THE BETA DECAY OF ^{109}Te. Bogdanov, D. D.; Karnaukhov. V. A.; Petrov, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1973. 23p. (In Russian). Dep. NTIS (U. S. Sales Only). $3.25.

The excitation functions for the delayed proton emitter ^{109}Te and for two alpha emitters produced in the bombardment of ^{96}Ru with ^{16}O ions were measured. The conclusion is that the mass numbers of the alpha-active isotopes of Te are equal to 109 and 108. The average ^{109}Te proton spectrum was analyzed on the basis of the statistical model of delayed proton emission. It was shown that the strength function of the β^+ decay of ^{109}Te has a local resonance at about 5 MeV excitation energy of the daughter nucleus. This resonance is interpreted as evidence for an intermediate structure involving the ($pg_{9/2}^{-1}$, $ng_{9/2}$, $nd_{5/2}$) state. (5 figures, 1 table) (auth)

29029 STUDY OF 250 MeV/NUCLEON ^{16}O ION INTERACTIONS. Kaiser, R.; Massue, J. P.; Pfohl, R.; Schmitt, R. (CNRS, Strasbourg). J. Phys. (Paris), Colloq.; No. 5, 172(1972). (In French).

In the framework of experiments carried out with the Berkeley Bevatron, ionographic emulsions were exposed to a 250-MeV/nucleon ^{16}O beam and to a 2.1-GeV/nucleon ^{12}C beam. The preliminary experimental results are presented: the mean free path is of the order of 13 cm and is in agreement with previous cosmic studies. (FR)

29030 MECHANISM OF HEAVY ION TRANSFER REACTIONS. Da Silveira, R. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 57(1972).

Angular distributions obtained from the neutron transfer reaction ^{14}N + Ag at 113 MeV are given. The parameters of the Woods–Saxon potential have been obtained from elastic scattering processes. (FR)

29031 EFFECT OF SPIN–ORBIT INTERACTION AT HIGH ENERGY. Raynal, J. (CEN de Saclay, Gif-Sur-Yvette, France). J. Phys. (Paris), Colloq.; No. 5, 149(1972). (In French).

The total cross sections obtained in a calculation of the 0^+, 2^+, 4^+ coupled equations for ^{22}Ne are presented together with the total cross sections obtained in the 2^+ microscopic model of ^{90}Zr without spin–orbit interaction and with a zero- and a finite-range spin–orbit interaction. (FR)

29032 LEVELS IN ^{115}In POPULATED IN THE DECAY OF ^{115m}Cd. Sergeev, V.; Becker, J.; Eriksson, L.; Gidefeldt, L.; Holmberg, L. (Univ. of Stockholm). Nucl. Phys.; A202: No. 2, 385-395(1973).

The decay of ^{115m}Cd to ^{115}In is studied. Gamma intensities are measured with a Ge(Li) detector. Two new transitions are observed and placed in the level scheme. The following γ-γ directional correlations are determined (energies in keV): 484.35-933.6, 158.1-1132.5 and 316.1-1132.5. The M1 strengths are dederived for two transitions connecting members of the vibrational multiplet: B(M1, 1290.5 $^{13}/_2^+$ → 1132.5 $^{11}/_2^+$) = 0.5 ± 0.1 μ_N^2 and B(M1, 1448.7 $^9/_2^+$ → 1132.5 $^{11}/_2^+$) = 0.5 ± 0.3 μ_N^2. The half-life of the 933.6 $^7/_2^+$ state as measured by the delayed-coincidence technique is $T_{1/2}$ = 57 ± 5 ps. The partial half-life of the 933.6 $^7/_2^+$ → 828.4 $^3/_2^+$ E2 transition is 55 times less than the Weisskopf estimate. The static quadrupole moment of the $^7/_2^+$ and $^3/_2^+$ states is evaluated on the assumption that these levels are members of the proposed rotational band: Q_0 = 2.7 ± 0.3 b. This is in agreement with the corresponding value for the 864.0 $^7/_2^+$ → 828.4 $^3/_2^+$ transition, and the result of a recent direct measurement of the static quad-

rupole moment of the 828.4 $3/2^+$ state. The suggestion that the 1418.0 $9/2^+$ level is also deformed is supported by the fact that the decay occurs preferentially to the 933.6 $7/2^+$ state, whereas no transition connecting the 1448.7 $9/2^+$ state with the 933.6 $7/2^+$ state is observed. (auth)

29033 POSSIBLE RESONANCE STRUCTURE IN THE ELASTIC SCATTERING OF NEUTRONS BY Y NEAR E_n = 1 MeV. Elwyn, J. (Argonne National Lab., IL); Monahan, J. E.; Cox, S. A.; Adams, J.; Chen, C. Nucl. Phys.; A202: No. 2, 241-256(1973).

The total cross section as well as the differential cross section and polarization in the elastic scattering of 0.8–1.4 MeV neutrons by Y have been measured with neutron beams of energy spread less than 20 keV. Rather weak structure with widths ≈50 keV was observed at a few energies within this range. The data were analyzed by use of a model in which the scattering process is described in terms of resonance amplitudes superimposed on an optical-potential background. Although not completely definitive, this analysis indicates the existence of three intermediate-width resonances (two 1^- and one 1^+) at neutron energies between ≈1.0 and 1.2 MeV. The properties of the 1^- resonances suggest that these are the parent states of the proposed $T_>$ components of the E1 giant resonance observed near 21 MeV excitation energy in ^{90}Zr produced in the ^{89}Y(p,γ_0) reaction. The resolved resonance structure in this energy region is in reasonable agreement with a recent calculation of the energies and widths of negative-parity states in ^{90}Y. (auth)

29034 Q-VALUES AND EXCITATION FUNCTIONS OF NUCLEAR REACTIONS. Part A. Hellwege, K. H. (ed.). Landolt Boernstein. Numerical data and functional relationships in science and technology. New series. Group I. Nuclear and particle physics. Volume 5. Berlin; Springer-Verlag (1973). 673p. (In English and German). $101.50.

An extensive list of Q values for nuclear reactions is provided. The targets considered range from ^{1}H to ^{254}Es. The following projectiles are included: γ, n, p, d, ^{3}He, α, ^{6}Li, ^{7}Li, ^{10}B, ^{11}B, ^{12}C, ^{14}N, ^{16}O, ^{18}O, ^{19}F, ^{20}Ne, ^{22}Ne, ^{31}P, ^{32}S, ^{40}Ar, ^{40}Ca, ^{64}Zn, ^{84}Kr, ^{127}I, and ^{132}Xe. The following combinations of outgoing particles are considered: xn, pxn, 2pxn, 3pxn, 4pxn, αxn, αpxn, and 2αxn. The number x of outgoing neutrons varies from 0 to 7 inclusive. Q values for reactions with other outgoing particles can be obtained by splitting up the complex outgoing particles into protons and neutrons and taking into account the corresponding binding energies. In addition, a table of mass excesses is included, with which unlisted Q values can be calculated. Instructions for using the tables are provided. (RWR)

29035 DROPLET MASS FORMULA FIT. Ludwig, S. (Univ., Wuerzburg, Ger.); von Groote, H.; Hilf, E.; Cameron, A. G. W.; Truran, J. Nucl. Phys.; A203: No. 3, 627-640(1973).

A mass fit of the droplet model is presented. To gain more confidence in the values of the thirteen coefficients used, the best-known isobar parabolas were fitted in addition. By this procedure the position and the width of the β valley were fitted; the symmetry, J, and the surface stiffness, Q, proved to be the only relevant parameters. Finally, the binding energy at the bottom of the β valley was refitted by altering the other parameters. The nuclear masses thus obtained are compared with experimental data as well as with the TCH model presented earlier. (7 figures) (auth)

29036 NUCLEAR DEFORMATION ENERGY CURVES WITH THE CONSTRAINED HARTREE–FOCK METHOD. Flocard, H. (Institut de Physique Nucleaire, Orsay, France); Quentin, P.; Kerman, A. K.; Vautherin, D. Nucl. Phys.; A203: No. 3, 433-472(1973).

Calculations of the deformation energy curves of relatively heavy deformed nuclei — Ce isotopes — were performed using the constrained Hartree–Fock technique. The two-body interaction was the Skyrme force, and pairing effects were taken into account. Different possible choices for the external field form were investigated, and the advantage of a nonlinear dependence of the constraint is shown. One of the advantages of this type of calculation is that deformation energy curves can be calculated without making a complete map of the deformation energy surface. A discussion of the numerical techniques and uncertainties, particularly those connected with truncation effects, is given. General trends of the deformation energy curves, calculated for the Ce isotopes as a function of the quadrupole moment, are found to be in good agreement with available experimental information. Associated physical quantities are discussed, and a comparison is made with the results of phenomenological calculations using the liquid-drop model and the Strutinsky prescription. (22 figures, 9 tables, 83 references) (auth)

29037 STRENGTH FUNCTIONS IN THE β-DECAY OF SHORT-LIVED FISSION PRODUCTS. Johansen, K. H. (Univ. of Aarhus, Denmark); Nielsen, K. B.; Rudstam, G. Nucl. Phys.; A203: No. 3, 481-495(1973).

Approximate β-strength functions were derived from measurements of the β^- feed to high-lying excited states in 40 neutron-rich nuclei. These nuclei, all produced in thermal fission, cover a broad range of nuclides from bromine to yttrium ($84 \leq A \leq 95$) and from silver to lanthanum ($116 \leq A \leq 143$). The β^- feed was determined by nonideal total γ-ray absorption. Above the cut-off energy expected from pairing, the strength functions in general increase smoothly with energy when no strong allowed single-particle strength is concentrated in the observed energy range. The increase is in these cases largely proportional to the nuclear level density. When allowed single-particle strength is likely to occur, the strength functions show significant structure even at higher energies (≈5 MeV), and the average strength then corresponds to a higher value of log-ft. These data are consistent with the theory of high-energy β decay in terms of a giant resonance, but draw attention to the persistence of significant shell structure in the tail part of the resonance, although the definite but smeared-out shell-model transitions are hindered as would be expected. Direct information on the β strength is needed for the evaluation of delayed neutron yields. The data provide such information for the well-known delayed neutron precursors ^{87}Br and ^{137}I. (5 figures, 1 table) (auth)

29038 β-DECAY OF ^{91}Sr. Halbig, J. K.; Wohn, F. K.; Talbert, W. L. Jr.; Eitter, J. J.; McConnell, J. R. (Ames Lab., Iowa). Nucl. Phys.; A203: No. 3, 532-538(1973).

Both the continuous β-ray spectrum and the internal conversion electron spectrum of ^{91}Sr were studied with a $\pi\sqrt{2}$ magnetic spectrometer. The measurements yield an intensity of 30.8% for the first-forbidden unique β-decay to the ground state and a Q value of 2.684 ± 0.004 MeV. The measured internal conversion coefficient of the 555.6-keV isomeric transition in ^{91}Y is in excellent agreement with the theoretical value for an M4 transition. Seven less intense internally converted transitions were also studied. The results verify the J^π assignments of earlier studies, and also provide new information for the transitions from which level structure configurations can be proposed. (2 figures, 1 table) (auth)

29039 γ-γ DIRECTIONAL CORRELATION IN THE DECAY OF ^{125}Xe AND ^{127}Xe IN THE CASE OF HIGH GAS DENSITY. Ledebur, T. V.; Eichler, R. (Eidgenoessische Technische Hochschule, Zurich). Helv. Phys. Acta; 46: 50-52(1973). (In German).

Angular correlation measurements were made on gamma cascades following decay of xenon at pressures of 600 to 1000 atmospheres. Results are compared with other experiments and also calculations. Corrections for finite solid angle, scattering, source size, and absorption in the source were included. It was shown that experiments at high pressure offer a new possibility for measurement of unperturbed correlations and of g factors. (1 table) (RWR)

29040 EXPERIMENTAL p-WAVE NEUTRON STRENGTH FUNCTIONS AND THE OPTICAL MODEL. Rama Rao, J.; Sriramachandra Murty, M.; Siddappa, K.; Lakshmana Rao, A. (Andhra Univ., Waltair, India). pp 67-72 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29041 NUCLEAR LEVEL STUDIES OF ^{99}Ru. Gupta, D. K.; Rangacharyulu, C.; Singh, R.; Rao, G. N. (Indian Inst. of Tech., Kanpur). pp 329-335 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29042 STRUCTURE OF THE GROUND STATE OF ^{149}Pm. Amadori, R. A.; Horgan, J. R. Jr.; Sastry, K. S. R. (Univ. of Massachusetts, Amherst). pp 337-341 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29043 DIRECTIONAL CORRELATION AND MULTIPOLE MIXING OF THE γ TRANSITIONS IN ^{99}Tc. Bhati, S. S.; Bhardwaj, A. K.; Singh, N.; Mangal, P. C.; Trehan, P. N. (Panjab Univ., Chandigarh, India). pp 381-384 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29044 γ-γ DIRECTIONAL CORRELATIONS IN ^{147}Pm. Bhardwaj, A. K.; Bhati, S. S.; Singh, N.; Mangal, P. C.; Trehan, P. N. (Panjab Univ., Chandigarh, India). pp 385-389 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29045 158 keV LEVEL IN ^{117}Sn. Chopra, R. C.; Hosangdi, R. R.; Tandon, P. N. (Tata Inst. of Fundamental Research, Bombay). pp 391-393 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29046 DECAYS OF ^{97}Zr AND ^{97}Nb. Tikku, V. K.; Singh, H.; Sethi, B. (Saha Inst. of Nuclear Physics, Calcutta). pp 455-459 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29047 STUDIES OF EVEN Sn NUCLEI FROM THE DECAY OF In. Nagarajan, T.; Fogelberg, B.; Backlin, A. (Swedish Research Council Lab., Studsvik). pp 461-465 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29048 β-γ CIRCULAR POLARIZATION CORRELATION IN ^{148}Pm. Padhi, H. C.; Mitra, S. K. (Tata Inst. of Fundamental Research, Bombay). pp 467-472 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29049 L/K ELECTRON CAPTURE RATIO FROM γ RAY-X-RAY SUM PEAK IN Ge(Li) SPECTRA. Dasmahapatra, B. K. (Saha Inst. of Nuclear Physics, Calcutta). pp 515-521 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29050 NOTE ON THE HALF-PERIOD OF ^{133}Ba. Lloyd, R. D.; Mays, C. W. (Univ. of Utah, Salt Lake City). Int. J. Appl. Radiat. Isotop.; 24: No. 3, 189-190(Mar 1973).

Although estimated values for the half-life of ^{133}Ba vary considerably, these tend to fall into two groups, one of about 7 to 8 yr and the other of 10 to 11 yr. However, after a search of the literature, the shorter half-life seems very questionable, as indeed some of the references to this value do not even appear to exist after all. Following a re-evaluation of the references and the addition of a new value of 11.3 ± 0.7 yr, it is regarded that 10.5 ± 0.5 yr is the best estimate of the true half-life. (UK)

29051 ^{110}Pd, ^{116}Cd(p,p'γ) REACTIONS. Deye, J. A.; Robinson, R. L.; Ford, J. L. C. Jr. (Oak Ridge National Lab., TN). Nucl. Phys.; A204: No. 2, 307-320(1973).

The possibility of extending our knowledge about higher-energy collective-type states among the vibrational nuclei by observing γ-rays from states excited by inelastically scattered protons has been examined. Gamma rays from ^{110}Pd and ^{116}Cd were detected in coincidence with inelastically scattered protons; the incident protons had energies of 12 and 13 MeV. Gamma rays, most of them previously unreported, were observed from 17 levels in ^{110}Pd and 14 levels in ^{116}Cd below ≈ 2.5 MeV. The results are compared to predictions of a phonon-model interpretation of the levels. Evidence is shown for the existence of the three-quadrupole phonon quintet in ^{110}Pd. (auth)

29052 ATOMIC MASSES AND FUNDAMENTAL CONSTANTS. 4. Proceedings of the Fourth International Conference Held at Teddington, England, September 1971. Sanders, J. H.; Wapstra, A. H. (eds.). London; Plenum Press (1972). 573p. (CONF-710931-). £10.00.

From 4th International Conference on Atomic Masses and Fundamental Constants; Teddington, UK (6 Sep 1971).

The 62 papers presented at the conference were divided into sections entitled: particle energies, beta and gamma energies, mass spectroscopy, Coulomb energies, mass formulae and mass calculations, velocity of light, wavelength comparisons, fine structure constant, 2e/h, Rydberg constant, magnetic moments, miscellaneous constants, evaluation, conference summary. Fifty papers are in NSA scope and separate abstracts have been prepared for these. One of the latter has already appeared as NSA 26: 10771. (UK)

For abstracts of individual chapters see: 27692-27694, 27768-27770, 28580-28582, 28587, 28607, 28608, 28628-28634, 28759, 28831-28834, 28841, 28913, 28914, 28933, 28934, 28957, 28958, 28994, 29008, 29053-29060, 29120, 29122, 29149, 29189-29191, 29366, and 29429.

29053 MASS MEASUREMENTS OF NEUTRON EXCESSIVE NUCLEI BY THE (^{11}B,^{8}B) REACTION. Scott, D. K.; Cardinal, C. U.; Fisher, P. S.; Hudson, P.; Anyas-Weiss, N. (Oxford Univ.). pp 54-63 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The feasibility of using the three neutron transfer reaction (^{11}B,^{8}B) as a technique for direct mass measurements is demonstrated. The accuracy obtained can be improved to better than 100 keV. The measurement of nuclear masses through charged particle transfer reactions of this type has the advantage that information on excited states is obtained simultaneously. It is shown that, with improved energy resolution, detailed information on highly excited states in nuclei far removed from stability can be obtained. (UK)

29054 INFLUENCE OF STRAGGLING EFFECTS ON THE ACCURATE MEASUREMENT OF NUCLEAR REACTION ENERGIES. Mueller, J. W. (Bureau International des Poids et Mesures, Sevres, France). pp 64-75 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The fact that particles do not lose their energy in a target continuously, but in discrete steps, can result in a considerable change of the apparent shape and position of a resonance. A method for determining the shift of the midpoint in a yield curve for thick targets is sketched, and numerical results are given in graphical form. (auth)

29055 DECAY ENERGIES OF FAR UNSTABLE NUCLEI. Westgaard, L. (European Organization for Nuclear Research, Geneva); Zylicz, J.; Nielsen, O. B. pp 94-104 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A number of studies of decay energies of nuclei far from stability are reported. Results are given of decay energy measurements on neutron-deficient cadmium isotopes and their daughters. The agreement with earlier measurements, partly performed with more accurate instruments, is consistent with the estimated accuracy of 100 to 200 keV on the values based on the positron spectra. No large discrepancies with the decay energies calculated from mass formulae are observed. The experiments have been extended to the largest distance from the stability line in the osmium-mercury region. Experimental Q-values for the 182 and 186 isobars are tabulated. (UK)

29056 COULOMB ENERGIES AND NUCLEAR SHAPES. Janecke, J. (Univ. of Michigan, Ann Arbor). pp 221-235 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A phenomenological Coulomb energy equation has been derived. The equation includes the effects of the diffuse surface and the deformation of the shape. It has been used in a least-squares analysis of the experimental Coulomb displacement energies, but can also be applied to the calculation of atomic masses. Agreement with a standard deviation of about 20 keV is obtained for the data on Coulomb displacement energies of nearly spherical nuclei with $Z \geq 28$; agreement with a standard deviation of about 30 keV is obtained for the data on all nuclei with $Z \geq 28$. Large amounts of excitations into higher shell model orbits for all nuclei are re-

quired to achieve this agreement. Values of $f \equiv R'/R$ (ratio of the equivalent radii of the neutron excess and the proton core) between 1.10 and 1.15 appear most reasonable. Neutron halos have been calculated and are found in very good agreement with the results from other calculations. The Coulomb displacement energies of statically and dynamically deformed nuclei (rotational and vibrational nuclei) are found to be smaller by up to 200 keV than corresponding spherical nuclei. Equations have been developed which describe the deformations as well as the isotope, isotone and isobar shifts of nuclear charge radii with reasonable accuracy. The isobar shifts of the neutron excess and the proton core are found to have opposite signs. (UK)

29057 DEFORMABLE MASS FORMULA AND FISSION DATA. Seeger, P. A. (Los Alamos Scientific Lab., NM). pp 256-266 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.) London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Development within the past decade of improved shell model and deformation corrections to the liquid-drop mass law has not only improved its accuracy but also allowed use in more aspects of nuclear physics, such as calculation of fission barriers. Additional experimental data are thus available as input for determination of mass-formula parameters. Preliminary results including fission barrier heights and fission Q-values as input data are presented. Statistical tests have been performed on fits to the 1971 mass table and to the input reactions and doublets: a possible discrepancy between the two forms of data is indicated. (auth)

29058 MASS EXTRAPOLATION AND MASS FORMULAE. Bos, K.; Wapstra, A. H. (Inst. for Nuclear Physics Research, Amsterdam). pp 273-277 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

For most experimental studies of nuclei far removed from stability it is desirable to have estimates of binding energies of nuclides in their ground state. Various approaches to the problem have been made. A new approach is considered here, which would consist of combining two of these, that of Bethe (1936), who tried to devise a mass formula representing as well as possible the masses of known nuclides and then (by inserting values of Z and A for the unknown nuclei) getting good estimates of their masses, and another method using a formula giving a relation between masses of adjacent (in an N vs Z plot) nuclei for stepwide extrapolation. First, a mass formula of sufficient quality must be selected; and then a systematic of the differences with the actual masses, set up; and, lastly, these systematics, extrapolated. Steps in the direction of such a solution are discussed. (UK)

29059 PROBLEMS CONNECTED WITH CALCULATIONS OF ATOMIC MASSES FROM EXPERIMENTAL DATA. Gove, N. B. (Oak Ridge National Lab., TN). pp 278-282 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Problems arising from the preparation of the 1971 Atomic Mass Evaluation are discussed. A number of new problems which were not apparent in the compilation of the 1961 and 1964 Atomic Mass Adjustments were due to amount, precision and interconnection of the data. It is considered that the complexity of future adjustments will probably increase. Interconnections between atomic masses and the fundamental constants are increasing. Future versions of the program may process calibration information as well as the Q-values, as is done in the present version. (UK)

29060 1971 ATOMIC MASS EVALUATION. Wapstra, A. H. (Inst. for Nuclear Physics Research, Amsterdam). pp 283-293 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

A short commentary is given on the meaning of the values and the estimates of their precision of atomic masses and related quantities of interest (binding energies of one or two nucleons, alpha and beta decay energies) which were calculated from experimental data in a consistent manner for inclusion in the 1971 Atomic Mass Evaluation. (UK)

29061 COINCIDENCE STUDIES OF ^{144}Pr WITH AN X-RAY DETECTOR. Mishra, R. K.; Richardson, H.O.W.; Thomas, R. N.; Thomas, R. V. (London Univ.). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 245-250(1972).

A coincidence technique was used in an attempt to set upper limits to the intensities of some unconfirmed γ-rays of ^{144}Pr. A lithium-drifted germanium γ-ray detector was used, and the estimated limits of the intensities of the six γ-rays in quanta per disintegration obtained were γ 66, $0.25 \pm 3.5 \times 10^{-5}$; γ 86, $-8.0 \pm 9.4 \times 10^{-5}$; γ 33; $<7.2 \times 10^{-4}$; γ 19.83; $3.7 \pm 1.7 \times 10^{-5}$; γ 21.09; 1.6×10^{-5}; and γ 74.60; $<1.2 \times 10^{-4}$. The absence of positive indication for the first three γ-rays gives no support for the existence of the level at 166 keV from which they are supposed to start. A positive indication is found for γ 19.83, but it is not conclusive because it only amounts to 2.3 times the statistical standard deviation. (UK)

29062 ELECTRON EMISSIONS OF SOME MASS SEPARATED FISSION PRODUCT ACTIVITIES. Adams, J. P. Ames, IA; Iowa State Univ. (1972). 97p. University Microfilms Order No. 73-3853.

Thesis (Ph. D.).

The beta-decay energies for seven short-lived radioactive nuclei produced at the TRISTAN experimental facility were measured using a plastic scintillator and a Ge(Li) detector in a beta-gamma arrangement. The beta-decay energies were compared with previous measurements and systematics predictions, and were used to predict the beta-decay energies for 5 additional nuclei by means of systematics. The beta-decay energies were also compared with 2 currently accepted mass formulas. In addition, an internal conversion electron measurement was made for the decay of 16-sec ^{140}Xe. Probable multipolarities for 18 gamma transitions in ^{140}Cs were determined and, on the basis of these multipolarities and the calculated log-ft values for the beta-fed levels in the decay scheme of ^{140}Cs, the spins and parities for 15 levels in this decay scheme are proposed. (Diss. Abstr. Int., B)

29063 NUCLEAR DATA SHEETS FOR A = 93. Kocher, D. C. (Oak Ridge National Lab., TN). Nucl. Data, Sect. B; 8: No. 6, 527-598(Dec 1972).

The 1960 version of the Nuclear Data Sheets for A = 93 was revised on the basis of experimental data received prior to November 1, 1972. Information from approximately 180 papers and communications was included in the present evaluation. Nine nuclei are known for A = 93. Only the presumed ground states and their half-lives have been established for ^{93}Kr, ^{93}Rb, and ^{93}Sr, and only fragmentary information on their decay schemes is available. The Q value for ^{93}Sr decay is not well determined experimentally. Decay studies and pickup reactions have established a few low-lying levels in ^{93}Y. Many spin assignments have been made for levels in ^{93}Zr on the basis of decay studies, transfer reactions, and measurements on isobaric analog resonances in ^{93}Nb. The decay schemes of long-lived ^{93}Zr and ^{93}Mo are still somewhat uncertain, since the existence of a decay to the ^{93}Nb ground state is not well established for either nucleus. Furthermore, the half-life of ^{93}Mo has not been directly measured. Low-lying levels in stable ^{93}Nb have been extensively studied via β-decay, Coulomb excitation, neutron inelastic scattering and transfer reactions, and an appreciable number of spin assignments are firm. Extensive β-decay, γ-decay, transfer and charge-exchange-reaction, and isobaric analog resonance measurements have led to many spin assignments for levels in ^{93}Mo. The nucleus ^{93}Tc has been studied via γ decay and transfer reactions, but few spin assignments are firm. Recent measurements indicate the existence of two levels in ^{93}Ru with approximately the same half-life, but the ordering of the levels and their decay properties are not well established. The well-established M4 γ decays of the first-excited states of ^{93}Nb and ^{93}Tc are found to have large enhancements of 13.2 and 26.7, respectively, the latter being the largest M4 enhancement known. The electron-capture decay of the first-excited state of ^{93}Tc also is found to have an unusually low log ft of 4.2. (auth)

29064 NUCLEAR DATA FOR A = 96 ISOBARS. Medsker, L. R. (Argonne National Lab., IL). Nucl. Data, Sect. B; 8: No. 6, 599-634(Dec 1972).

Nuclear Data for the A = 96 isobars were revised on the basis of experimental data received prior to August 1972. Information from approximately 130 papers and communications was included in the present compilation. (auth)

29065 NUCLEAR DATA SHEETS FOR A = 91. Verheul, H.; Ewbank, W. B. (Oak Ridge National Lab., TN). Nucl. Data, Sect. B; No. 6, 477-526(Dec 1972).

The 1960 version of Nuclear Data Sheets for A = 91 was revised. Only 29 of the 57 references given in the older compilation were preserved, while ≈150 new references were added. All the old references concern radioactivity measurements where results are often imprecise and sometimes conflicting. Absolute normaliza-

tions for the decay schemes of ^{91}Kr, ^{91}Rb, and ^{91}Tc are not given because no β intensities are known. Absolute normalizations for both ^{91}Mo isomers are still tentative because of uncertainty in the β^+ intensities. For 62-d ^{91}Nb the absolute normalization depends on a preliminary γ-intensity ratio and an assumption about possible β^+ feeding to the ^{91}Zr g.s. No information is yet available about decay of the ^{91}Nb g.s. Much detailed reaction data is available for states in ^{91}Zr and ^{91}Nb, although available information on γ branching is still incomplete for ^{91}Zr and conflicting for ^{91}Nb. Detailed reaction information is also becoming available for ^{91}Y and ^{91}Mo. The mass difference ^{91}Zr–^{90}Zr determined from an (n,γ) experiment disagrees by 43 ± 3 keV with the value determined from mass-spectrometer and (d,p) reaction data. All data received in Oak Ridge before October 1972 were considered in constructing the adopted level schemes. (auth)

29066 INVESTIGATION OF THE COLLECTIVE PROPERTIES OF THE ^{124}Te, ^{152}Gd, ^{152}Sm, AND ^{166}Er NUCLEI. Baker, K. R. Nashville, TN; Vanderbilt Univ. (1972). 172p. University Microfilms Order No. 73-1610.

Thesis (Ph. D.).

Gamma-gamma directional correlation measurements were made on nine transitions in ^{124}Te with a NaI(Tl)-Ge(Li) detector arrangement and multichannel analysis. The multipole mixing ratios obtained were $\delta(646) = 0.000 \pm 0.001$, $(714) = 1.5^{+0.6}_{-0.3}$, $\delta(723) = -3.3 \pm 0.2$, $\delta(1437) = 3.7^{+2.7}_{-2.0}$, $\delta(1489) = -3.3^{+0.8}_{-1.5}$, $\delta(968) = -0.03^{+0.08}_{-0.05}$, $\delta(1368) = 0.045 \pm 0.090$, $\delta(1045) = 0.041^{+0.047}_{-0.041}$, $\delta(1691) = -0.02 \pm 0.01$, and $\delta(2091) = 0.00^{+0.03}_{-0.03}$. The first δ is M3/E2, the next three are E2/M1, and the last five are M2/E1. The retardation (a factor of approximately 50) of the crossover to cascade transitions from the 2039-keV, third 2^+ level to the second and first 2^+ levels is essentially the same for both the M1 and E2 components. In addition, spin and parity assignments of 2^+ were made for the 2039- and 2092-keV levels. The decay of 12.4 y ^{152}Eu to ^{152}Sm and ^{152}Gd was studied in a high resolution singles measurement and two 4096 × 2048 Ge(Li)–Ge(Li) coincidence studies. Forty-five gates were analyzed in order to confirm or establish the placement of the γ rays as well as to accurately determine the intensities of the 12 doublets, which included several not previously reported. Two new γ-β interband transitions, $4^+_\gamma \rightarrow 2^+_\beta$ (561.4 keV), and $3^+_\gamma \rightarrow 2^+_\beta$ (423.7 keV), and a new 330.9 keV transition between the 4^+_γ level and the $I^\pi K = 3^-0$ octupole level were established from coincidence data. Levels at 1757.0 keV in ^{152}Sm and 1282.5, 1318.7, and 1692.2 keV in ^{152}Gd are now established on the basis of coincidence data. These data also establish for the first time the population in the ^{152}Eu decay levels at 1680.0 and 1047.9 keV in ^{152}Sm and ^{152}Gd, respectively, as well as a new level at 1700.8 keV in ^{152}Sm. Directional correlation measurements were made in order to determine the E2/M1 admixture for nine gamma-ray transitions from the gamma band to the ground band in ^{166}Er. NaI–Ge(Li) and Ge(Li)–Ge(Li) detector arrangements were used to measure the correlations of transitions in coincidence with the $6^+ \rightarrow 4^+$, $4^+ \rightarrow 2^+$, and $2^+ \rightarrow 0^+$ transitions within the ground band. The M1 admixtures were found to be less than one percent for the more accurately measured transitions. The results compare favorably to a theoretical prediction for M1 transitions. Gamma- and ground-band mixing are shown to be negligible for the M1 component. The spins of three high energy levels at 1664, 1691, and 1784 were measured to be 5, 5, and 6, respectively. (Diss. Abstr. Int., B)

29067 FAST NEUTRON SPECTROMETER, (p,n) REACTION STUDIES, AND MICROSCOPIC ANALYSES. Bentley, R. F. Boulder, CO; Univ. of Colorado (1972). 197p. University Microfilms Order No. 73-1751.

Thesis (Ph. D.).

The design and construction of a neutron time-of-flight spectrometer used to study the (p,n) reaction at an incident proton energy of 23 MeV are described. The spectrometer was designed primarily to obtain neutron angular distributions in the range of 10 to 150 degrees with respect to the incident beam. Thirty-five target nuclei were chosen for the (p,n) survey, ranging in mass from ^{9}Be to ^{208}Pb and including several isobaric and isotopic sequences. In the nuclei above mass 90 only transitions to isobaric analogue states of the target nuclei were observed, but for targets below mass 60 several other low-lying states were usually resolved. Many representative transitions were analyzed in the distorted-wave Born approximation with simple shell-model wave functions and an effective nucleon–nucleon interaction. Sensitivity to optical potentials and nuclear wave functions was investigated, and the strengths of the charge-exchange terms in the effective potential were extracted. Because of fluctuations in these strengths and the inability of the model to fit the shapes of many observed neutron angular distributions, the model is considered inadequate. A prescription which introduced imaginary terms in the interaction was studied, but did not consistently improve the results. Coupled-channels calculations were carried out with the coupling to an intermediate deuteron state. The effects of the two-step (p,d) (d,n) process were large and, in the few cases studied, seem to improve agreement with the data. (RWR)

29068 COULOMB BARRIER AND NUCLEAR SIZE STUDIES IN THE NEODYMIUM AND TIN ISOTOPES. Tabor, S. L. Stanford, CA; Stanford Univ. (1972). 131p. University Microfilms Order No. 73-4609.

Thesis (Ph. D.).

The primary purpose of this thesis is the measurement of differences in nuclear matter sizes of isotopes by observation of the onset of strong interaction effects in Rutherford scattering. Elastic alpha scattering cross sections of the even neodymium and tin isotopes were measured with a precision of about 1%. Observations were made simultaneously at 6 angles between 30° and 165° and at energy intervals of 0.5 MeV between 9 and 17 MeV for tin and between 11 and 19 MeV for neodymium. Elastic oxygen scattering cross sections of the same tin isotopes have been measured with a precision of about 2%. The oxygen energy was incremented in 1 MeV steps in the range of 48 to 59 MeV. The dominant effect observed in the data is an exponential decrease in the cross section relative to Rutherford when the beam energy is increased beyond a characteristic value. The behavior of the data is qualitatively independent of isotope. The shape of the curve remains constant but is displaced to slightly lower bombarding energy as neutron number increases among the isotopes. Cross sections relative to Rutherford are graphed as a function of classical distance of closest approach of the colliding bodies. The plot permits a comparison of alpha and oxygen scattering results and shows that effects of the nuclear force occur more rapidly as a function of distance in oxygen than in alpha scattering. Two models have been employed to determine effective interaction potentials. One is the standard optical model with a nuclear potential of the Woods–Saxon form, in which there are four free parameters. The other (I.W.B.) is based on the fact that alpha scattering occurs near the nuclear surface. It uses an exponential nuclear potential with two parameters. Both models yield predictions which agree well with the data both qualitatively and quantitatively. Certain features of the potential distributions are determined by the data better than others. One quantity which is rather well defined as the radius of the barrier or "Rutherford" radius. This is the radius at which the total potential, Coulomb plus nuclear, achieves its maximum. The parameter which is determined best is the point at which the nuclear potential has fallen to a certain percentage (e.g., 2%) of the Coulomb potential. This is an indication that the experiment is sensitive to the surface. These two measures of the interaction distance are displayed for the tin and neodymium isotopes. The trend is an increase with increasing neutron number which is of the order of 1.4 $A^{\frac{1}{3}}$. These results are compared with proton and electron scattering measurements. There is reasonable agreement with the proton scattering results on tin. The matter sizes determined from these measurements increase more rapidly than the charge radii in both the tin and neodymium isotopes. (Diss. Abstr. Int., B)

29069 CONSTRAINED HARTREE–FOCK CALCULATIONS FOR A < 200 NUCLEI. Flocard, H.; Quentin, P.; Vautherin, D. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 4(1972).

The constrained Hartree–Fock method using the Skyrme interaction is applied to some light and medium nuclei. The variational calculation of the nuclear energy, a quadratic constraint is imposed on the quadrupole moment. An approximate treatment of the pairing residual interaction is also included. Solutions with axial and reflexion symmetry with respect to an equatorial plane are considered. Deformation energy curves obtained in this self-consistent way for ^{104}Zr, ^{126}Ce, ^{134}Ce, ^{140}Ce, ^{150}Ce and ^{170}Yb are presented. (FR)

29070 INVESTIGATION OF THE ^{126}Ba → ^{126}Cs → ^{126}Xe DECAY. Blinowska, K. J.; Chojnacki, S.; Droste, C.; Morek, T.; Srebrny, J. (Univ., Warsaw). Acta Phys. Pol.; B4: No. 1, 75-80(1973).

The neutron deficient ^{126}Ba isotope was produced in the ^{118}Sn(^{12}C,4n)^{126}Ba reaction at carbon ions energy E = 72 MeV. The decays of $^{126}_{56}$Ba → $^{126}_{55}$Cs → $^{126}_{54}$Xe and ^{126}Cs → ^{126}Xe were investigated by means of Ge(Li) detectors. The ^{126}Ba → ^{126}Cs decay scheme is presented. (auth)

29071 STUDY OF THE DECAY OF ^{134}Cs BY BETA–GAMMA–GAMMA ANGULAR-CORRELATION MEASUREMENTS. Dahiya, H. S.; Singh, B. P. (Univ. of Roorkee, India). Indian J. Pure Appl. Phys.; 10: No. 8, 585-589(Aug 1972).

Beta–gamma–gamma angular correlation measurements have been made for the cascades: β-group of E_{max} (658 keV) → γ-rays

(796 keV) → γ-rays (605 keV) and β-group of E_{max} (415 keV) → γ-rays (1039 keV) → γ-rays (605 keV), using two NaI(Tl) detectors and one plastic detector mounted in the plane of the table. The multipolarity of the 1039 keV gamma transition is determined and spins of the excited levels are confirmed. (auth)

29072 GAMMA DECAY PROPERTIES OF 3^- LEVELS IN EVEN–EVEN NUCLEI. Roehmer, F. C. (Swiss Federal Inst. of Tech., Zurich). Helv. Phys. Acta; 26: 99-128(1973).

The gamma-decay characteristics of 3^- states in ^{38}Ar, ^{140}Ce, and ^{160}Dy were investigated using radioactive sources. The discrepancy between conflicting energy values reported for the gamma rays depopulating the 3^- level in ^{38}Ar was removed, and this state was shown to lie at 3808 ± 2 keV. The E3 ground-state transition was observed, and an enhancement factor of 17 ± 4 relative to the single particle unit (s.p.u.) was deduced. From gamma–gamma angular correlation measurements on the 867.8–1596.6 keV cascade the spin and parity of the 2464.4-keV level in ^{140}Ce were determined to be 3^-. The ground-state transition from this state was discovered, and an intensity limit for the $3^- \rightarrow 4_1^+$ transition was obtained. From these data it follows that the $3^- \rightarrow 2_1^+$ transition is the fastest one of this type with B(E1) = (3.1 ± 0.5) · 10^{-3} s.p.u.; the $3^- \rightarrow 4_1^+$ transition has B(E1) < 5.5 · 10^{-5} s.p.u.; the ratio B(E1, $3^- \rightarrow 4_1^+$)/B(E1, $3^- \rightarrow 2_1^+$) < 1.6 · 10^{-2} is the smallest one yet known. The 1286-keV transition in ^{160}Dy, which formerly was tentatively interpreted as the ground-state transition from the 3_1^- level at 1286.7 keV, was proven not to originate from this level. An intensity limit for the ground-state transition from the 3_2^- state at 1399.0 keV was determined. A compilation of some properties of the lowest 3^- states of even–even nuclei is presented. The excitation energies show pronounced shell effects (maxima at N = 28, 50, 82, 126 and Z = 28, 50, 82); the excitation probabilities B(E3) are not positively related to the magic numbers. The largest B(E1, $3^- \rightarrow 2_1^+$) values are observed at N = 20 and 82, but the data are too scarce to recognize any regularity. Together with the angular correlation of the 867.8–1596.6-keV gamma cascade in ^{140}Ce, correlations of five transitions in the energy region of 750–950 keV were also measured and their mixing ratios were determined. The spin and parity assignments for the corresponding levels were confirmed. (25 figures, 4 tables) (auth)

29073 NUCLEAR FLUORESCENCE OF ^{115}In. Boivin, M.; Cauchois, Y.; Heno, Y.; Zecevic, V. (Univ., Paris). Nucl. Phys.; A204: No. 1, 220-224(1973). (In French).

Continuous radiation (bremsstrahlung) from a 2-MeV electron accelerator has been used to excite seven nuclear levels in ^{115}In, at 1133, 1291, 1449, 1464, 1487, 1498 and 1610 keV. Mean-life values were calculated for the first five levels and the δ^2 ratio was also determined for those at 1133 and 1464 keV. (auth)

29074 MICROSCOPIC, ANHARMONIC QUASIPARTICLE–PHONON COUPLING THEORY FOR VIBRATIONAL NUCLEI. Borse, G. J. (Lehigh Univ., Bethlehem, PA). Nucl. Phys.; A204: No. 1, 149-160(1973).

A microscopic method of describing quasiparticle-phonon coupling, based upon an equation-of-motion technique for the pairing plus quadrupole Hamiltonian, retaining anharmonic terms, is used to calculate the spectra of both even and odd isotopes of paladium and cadmium. The spurious states in the odd nucleus calculation are removed before diagonalization. The basis is up to three phonons for even nuclei and up to two phonons plus a quasi-particle for odd nuclei. (auth)

29075 TRANSITIONS, WITH CHANGE IN PARITY, PRODUCED IN ^{107,109}Ag BY COULOMB EXCITATION. Cottrell, C. W. (Oxford Univ.). Nucl. Phys.; A204: No. 1, 161-171(1973).

Some of the low-lying energy levels of ^{107}Ag and ^{109}Ag were excited by Coulomb excitation using α-particles from 4.8 to 7.2 MeV. Transitions to the isomeric state ($^7/_2^+$), involving a parity change, were observed both directly in the singles spectra and indirectly by the decay of the isomer. The isomer in both silver isotopes was populated by transitions from the $^5/_2^-$ level, which was strongly excited. The observed branching ratio in ^{109}Ag for the $^5/_2^- \rightarrow {}^1/_2^+$ transition was (0.315 ± 0.09)% and for the $^5/_2^- \rightarrow {}^3/_2^+$ transition was (0.055 ± 0.03)%. The total rate of populating the $^1/_2^+$ level from the $^5/_2^-$ level was (0.215 ± 0.04)% in ^{107}Ag. The level schemes have been discussed on the weak-coupling model, allowing admixtures of single-particle wave functions to account for the weaker transitions. (auth)

29076 INTERNAL CONVERSION INVESTIGATIONS FOR THE 127.37 keV E3 TRANSITION IN ^{134}Cs. Martin, B.; Merkert, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Czech. J. Phys.; 23: No. 3, 297-305(1973).

Relative conversion line intensities of the 127.3-keV E3 isomeric transition in ^{134}Cs have been measured for ten atomic subshells, using the $(\pi/2)\sqrt{13}$ beta-ray spectrometer. The multipolarity E3 + (0.07 ± 0.04)% M4 was determined. Internal conversion coefficients were calculated in different physical approximations. Precise calculations were performed for two atomic models (non-relativistic Hartree–Fock–Slater and relativistic Hartree–Fock–Slater). Experimental data were found in agreement with tabulations of Hager and Seltzer and mentioned calculations. An upper limit for the γ-branching ratio γ(138.6 keV M4)/γ(127.37 keV E3) was found to be 0.2%. The measurement of the half-life of the isomeric state has been carried out with a NaJ(Tl) crystal. The result obtained is $T_{\frac{1}{2}}$ = (2.95 ± 0.02) h. (auth)

29077 PRE-EQUILIBRIUM α-PARTICLE EMISSION IN THE ^{115}In(p,α)^{112}Cd. Braga-Marcazzan, G. M. (Univ., Milan); Milazzo-Colli, L.; Signorini, C. Lett. Nuovo Cim.; 6: No. 10, 357-361(10 Mar 1973).

It has been shown that α particles are emitted from heavy nuclei under n bombardment by a preequilibrium reaction mechanism; this supports the fact that the α particle is performed in the target nucleus and behaves like one particle in the reaction. The ^{115}In(p,α)^{112}Cd reaction was studied to get experimental information about this new reaction mechanism from charged-particle reactions. The experiment was performed at 16 to 18 MeV, and α particles were detected at 50 and 90°; four spectra are shown, with evaporative and preequilibrium parts. In this description the incoming proton, once it has entered the nucleus, hits an α particle with a certain probability. In this way one has a (preequilibrium) excited state formed by three excitons: the proton, the α particle, and the α hole. This excited state can decay either by α emission to the continuum or to a state made of 5 excitons by particle or hole scattering (other decay channels can be neglected). Then the cascade goes on, increasing the exciton number by two in each step. In the present case the most important contribution to the calculation is the one from the first state (three-exciton state), which is about 80% of the total preequilibrium contribution. While the preequilibrium emission of an α particle from a 3-exciton state can be called a knockout mechanism, the description of the residual state (1 particle, 1 α hole) is complicated by the presence of the α-hole level density. Thus, the interpretation is not simple. A formula is given for the shape of the higher-energy part of the α spectrum; it reproduces the data well. (1 figure, 1 table) (RWR)

29078 CROSS SECTIONS FOR THE (n,n′) AND (n,2n) REACTIONS ON ^{113}In AND ^{204}Pb. Decowski, P.; Grochulski, W.; Karolyi, J.; Marcinkowski, A.; Piotrowski, J.; Saad, E.; Wilhelmi, Z. (Univ., Warsaw). Nucl. Phys.; A204: No. 1, 121-128(1973).

The cross sections for the $(n,n')^m$ and (n,2n) reactions on the target nuclei ^{113}In and ^{204}Pb were measured by the activation method in the neutron energy range 13 to 18 MeV. The results were compared with the predictions of compound nucleus theory. The angular momentum effects and the γ-decay of unbound states were taken into account. (auth)

29079 SPECTRUM OF INTERNAL CONVERSION ELECTRONS EMITTED AT THERMAL NEUTRON CAPTURE BY ^{149}Sm NUCLEI. Berzin, Ya. Ya.; Kruminya, A. E.; Prokof'ev, P. T. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 1, 3-14(1973). (In Russian).

The conversion electron spectrum emitted by reaction ^{149}Sm(n,γ)^{150}Sm has been investigated using a β-spectrograph with resolution 0.07 to 0.3%. The 337 lines are found in the electron energy region from 28 to 1550 keV, with 96 lines for the first time. Multipolarities are assigned to most of the transitions. Several levels are added to the scheme. It is found from the given transition probability ratios that the levels 1255.6 (0^+), 1417.5 (2^+) and 1642.7 (4^+) belong to one quasirotational band with $K^\pi = 0^+$. (auth)

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Refer also to abstracts 28913, 28950, 28978, 29034–29036, 29040, 29055, 29056, 29066, 29069, 29072, 29146, and 29243.

29080 MOESSBAUER EFFECT STUDIES OF EXCITED STATES OF ^{155}Gd. Armon, H.; Bauminger, E. R.; Ofer, S. (Hebrew Univ., Jerusalem). Phys. Lett., B; 43B: No. 5, 380-382(5 Mar 1973).

Moessbauer effect studies of the 60.0, 86.5 and 105.3 keV transitions of ^{155}Gd, yield the following nuclear parameters: $\tau_{\frac{1}{2}}$ (60 keV level) = 194 ± 15 ps, g(87)/g(0) = 1.235 ± 0.008, g(105)/g(0) = 2.01 ± 0.05 or −0.55 ± 0.05; Q(87)/Q(0) = +0.087 ± 0.006 and Q(105)/Q(0) =

1.16 ± 0.03. Theoretical considerations favor the first set of values of Q(87)/Q(0) and Q(105)/Q(0). (auth)

29081 VIBRATIONAL BAND STRUCTURE IN ^{184}W POPULATED IN THE DECAY OF ^{184}Re. Canty, M. J.; Guenther, C.; Herzog, P.; Richter, B. (Univ., Bonn). Nucl. Phys., A; A203: No. 2, 421-432(1973).

The decay of ^{184m}Re has been investigated through γ-ray and conversion electron studies. The band head of the $K^\pi = 2^-$ octupole band has been established at 1130.0 keV. The E2/M1 mixing ratios of three transitions from the γ-vibrational band to the ground state band have been determined by angular correlation measurements. A mixing of E1, M2 and E3 multipolarity has been derived for the 921 keV transition combining angular correlation and conversion electron data. A value $B(E3, 0^+ \rightarrow 3^-) = (25 \pm 5) \times 10^4\ e^2 \cdot fm^6$ was obtained from the measured E2/M1 mixing of the 91 keV $3^- \rightarrow 2^-$ transition and γ-branchings. The data are discussed in terms of the collective model taking into account band mixing. (auth)

29082 ELECTROMAGNETIC TRANSITIONS IN ^{176}Hf STUDIED BY THE (α,2n) REACTION. Hammer, T.; Ejiri, H.; Hagemann, G. B. (Univ. of Copenhagen). Nucl. Phys.; A202: No. 2, 321-334 (1973).

The E0, E2, and M1 matrix elements were obtained for the interband transitions between levels with spin up to 6 in the β-vibrational and the ground-state of ^{176}Hf by studying the following reactions: ^{176}Hf(α,α′)^{176}Hf, ^{174}Yb(α,2nγ)^{176}Hf and ^{174}Yb(α,2ne)^{176}Hf. The interband E2 transition matrix elements are small and in agreement with the collective model with rotation-vibration interactions included. The ratios of the E0 to E2 matrix elements are constant over spins 2-6 in agreement with the collective model. The value $(g_K - g_R)$ for states in the isomeric bands built on 6^+ and 8^- states is obtained. (auth)

29083 LOW-K BANDS IN ^{176}Hf POPULATED IN THE (α,2n) REACTION. Kho, T. L.; Waddington, J. C.; Preibisz, Z.; Johns, M. W. (McMaster Univ., Hamilton, Ont.). Nucl. Phys.; A202: No. 2, 289-320(1973).

Levels in ^{176}Hf have been studied by the ^{174}Yb(α,2n)^{176}Hf reaction. The observation of γ-rays both in singles and coincidence experiments, and the measurement of internal conversion coefficients of many of these transitions have led to the assignment of eleven rotational bands. Those bands with low K are discussed. They are the ground state band, a $K^\pi = 0^+$ band at 1150 keV, a $K^\pi = 2^-$ band at 1247.5 keV, a third $K^\pi = 0^+$ band at 1293 keV, a $K^\pi = 2^+$ at 1341.1 and finally a $K^\pi = 3^+$ band at 1577.3 keV. The properties of these bands will be discussed. In particular, a suggested explanation for the unusual decay pattern of the $K^\pi = 2^-$ band will be presented. (auth)

29084 HEXADECAPOLE DEFORMATION IN THE WOLFRAM NUCLEI. Kleinheinz, P. (Univ. of Copenhagen); Casten, R. F.; Nilsson, B. Nucl. Phys.; A203: No. 3, 539-560(1973).

The (^{3}He,α) and (d,t) reactions were used to investigate the positive-parity intrinsic excitations in ^{179,181,183,185}W stemming from the $i_{13/2}$ spherical shell-model state. The $^{13}/_2{}^+$ members of the rotational bands built on each of these orbitals are expected to be populated strongly in neutron-transfer reactions due to the near-unity values of the $C_{j=13/2}$ coefficients. These states were populated in the (^{3}He,α) reaction, which favors transfer of high angular momentum. The assignments of l values were based on the measured ratio of (^{3}He,α) to (d,t) cross sections populating the same state. The Nilsson model, with the inclusion of pairing and Coriolis mixing, was unable to account for the experimental results, namely, the observation of all the expected strength localized in only two or four states below 2 MeV of excitation. Much better agreement with experiment was obtained if the extended Nilsson model including a hexadecapole deformation of $\epsilon_4 \approx +0.06$ was used as a starting point for a Coriolis-coupling calculation. (8 figures, 3 tables) (auth)

29085 PROPERTIES OF NUCLEAR STATES IN ^{182}Re POPULATED IN THE DECAY OF ^{182}Os (22h). Burson, S. B. (Argonne National Lab., IL); Daly, P. J.; Goudsmit, P.F.A.; Klaasse, A.A.C. Nucl. Phys; A204: No. 2, 337-356(1973).

Information about the excited states of the doubly odd nuclide $^{182}_{75}$Re has been deduced from studies of the radioactive precursor, $^{182}_{76}$Os (22 h). The γ-ray spectra were measured with several Ge(Li) detectors; the internal-conversion-electron groups were studied with Si(Li) and magnetic spectrometers. Delayed as well as prompt γ-γ coincidence experiments were performed. Fifty-seven transitions are reported in the energy region below 800 keV; 41 of these are assigned between 14 excited states (not including the ground state). The energies of the excited states are determined by making a least-squares fit to the γ-rays assigned between the various pairs of levels. Spin and parity assignments are proposed for most of the levels. An interpretation of some of the states is presented in terms of the Nilsson model and the Gallagher–Moszkowski coupling rules. The half-life of the level at 235.77 keV was measured to be 570 ± 30 ns (in agreement with the value reported by Akhmadzhanov et al.). Reasons are presented for interpreting this level as the $(p[402]\uparrow - n[521]\downarrow)$, $I^\pi = 2^-$ configuration; decay to the ground-state band is thus threefold Ω-forbidden. The influence of this forbiddenness on transition probabilities is discussed. (auth)

29086 ALTERNATING ENERGY TERM FOR ROTATIONAL LEVELS OF ODD-MASS RARE EARTH NUCLEI. Joshi, P. C.; Sood, P. C. (Banaras Hindu Univ., India). pp 247-253 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From Nuclear Physics and Solid State Physics Symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

29087 GROUND STATE SPIN-PARITIES OF ODD–ODD RARE-EARTH NUCLEI. Gupta, D. K.; Sood, P. C. (Banaras Hindu Univ., India). pp 255-260 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29088 STUDY OF ROTATIONS OF DEFORMED EVEN–EVEN NUCLEI. Prakash, V. R.; Bahal, B. M.; Deshpande, V. K. (Indian Inst. of Tech., Kanpur). pp 261-265 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29089 SPECTRA, STATIC MOMENTS, AND TRANSITION PROBABILITIES OF ODD–ODD NUCLEI ^{168}Tm AND ^{164}Ho. Sharma, S. D. (Panjabi Univ., Patiala, India). pp 291-294 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29090 NUCLEAR LIFETIME MEASUREMENTS OF SOME EXCITED STATES IN ^{75}As, ^{131}Cs, ^{133}Cs, ^{170}Yb, ^{187}Re, AND ^{197}Au. Gupta, D. K.; Rao, G. N. (Indian Inst. of Tech., Kanpur). pp 343-348 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29091 MAGNETIC MOMENT OF THE 3-, 1374 keV LEVEL OF ^{183}W. Singh, B.; Dhar, A. K.; Singh, V.; Hans, H. S. (Panjab Univ., Chandigarh, India). pp 353-355 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29092 HIGH-RESOLUTION INTERNAL CONVERSION MEASUREMENTS IN THE DECAY OF ^{177}Lu, ^{177m}Lu, AND ^{177}Yb. Gopinathan, K. P. (Tata Inst. of Fundamental Research, Bombay); Agnihotry, A. P.; Patel, S. B.; Joshi, M. C.; Bidarkundi, M. S. pp 425-430 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29093 PENETRATION EFFECTS IN INTERNAL CONVERSION OF TRANSITIONS IN ^{177}Lu AND ^{177}Hf. Gopinathan, K. P.; Agnihotry, A. P. (Tata Inst. of Fundamental Research, Bombay). pp 431-435 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29094 ELECTROMAGNETIC TRANSITIONS IN ^{186}W, ^{186,188}Os. Subba Rao, B. N. (Tata Inst. of Fundamental Research, Bombay). pp 437-443 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29095 PHOTONEUTRON CROSS SECTIONS FOR ^{182}W AND ^{184}W. Sorokin, Yu. I.; Khrushchev, V. A.; Yur'ev, B. A. (Moscow State Univ.). Yadern. Fiz.; 17: No. 1, 3–8(Jan 1973). (In Russian).

The curves of photoneutron yield have been measured and the cross sections for (γ,xn) reactions on ^{182}W and ^{184}W isotopes from the threshold up to 27.4 MeV have been calculated. The introduction of corrections for multiplicity allows one to determine the cross-section for γ-quantum absorption. The value of quadrupole moments of investigated nuclei have been obtained from analysis of giant resonance form on the basis of hydrodynamic model. The comparison of the obtained cross sections with theoretical calculations is being carried out. (auth)

29096 DECAY OF ^{172}Ta. Cardoso, M. H.; Goudsmit, P.F.A.; Konijn, J. (Inst. for Nuclear Physics Research, Amsterdam). Nucl. Phys.; A205: No. 1, 121-138(1973).

The energies and relative intensities of 107 γ-rays following the decay of 37.0 ± 0.5 min ^{172}Ta have been measured using anti-Compton and surface-barrier Ge(Li) spectrometers. Conversion-electron spectra were measured with Si(Li) detectors. Several E0 and E0 + M1 + E2 transitions have been observed. Gamma-gamma and positon-γ coincidence measurements have been performed. A value of Q = 4.92 ± 0.18 MeV for the decay energy has been deduced from the experiments. The main β-decays proceed through allowed or first-forbidden transitions to the 1418.66 keV (4^-) and 1639.77 keV (3^-) states for which Nilsson assignments are proposed. In addition to the ground-state band, several K = 0 bands were found with band heads at 871.34, 1295.63 and 1335.69 keV. The members of a γ-vibrational band were observed at 1075.29 keV (2^+), 1180.85 keV (3^+) and 1304.88 keV (4^+). (auth)

29097 MAGNETIC MOMENTS OF ^{168}Er STATES, EXCITED BY NEUTRON CAPTURE. Alfimenkov, V. P.; Zhukov, G. P.; Zimin, G. N.; Lason, L.; Mareev, Yu. D.; Ovchinnikov, O. N.; Pikel'ner, L. B.; Salamatin, I. M.; Tishin, V. G.; Shapiro, F. L.; Sharapov, E. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 17: No. 1, 13-30(Jan 1973). (In Russian).

Using the method of neutron transmission through a polarized target magnetic moments of neutron resonances in ^{167}Er with energy 0.460 and 0.584 eV were measured. The following values have been obtained μ_J (0.460) = (0.9 ± 0.4) μ_N and μ_J (0.584) = (1.8 ± 0.9)μ_N. (auth)

29098 DECAY OF ^{152}Eu. Walton, T. G. Vancouver; Univ. of British Columbia (1972). National Library of Canada at Ottawa. Thesis (Ph. D.).

The excited states of ^{152}Sm and ^{152}Gd obtained from the decay of ^{152}Eu were investigated. Precise measurements of the energies and intensities of the gamma-ray transitions have been made using Ge(Li) detectors. The placement of transitions in the decay schemes was aided by Ge(Li)–Ge(Li) coincidence measurements. 58 gamma-rays were observed in the decay of ^{152}Eu and 37 coincident transitions. Sixteen of the coincident transitions were observed for the first time in this work. The three lowest energy members of the ground state, β and γ-vibrational bands were observed in ^{152}Sm. Two K = 0^- levels were identified in ^{152}Sm having B(EL) ratios agreeing with adiabatic symmetric rotation model predictions. An alternate K assignment is suggested for the I = 2^- and 3^- levels at 1530 keV and 1579 keV. The effect of including band mixing in the calculations of the B(E2) ratios by the symmetric rotation model was investigated for transitions from the β and γ-vibrational bands of ^{152}Sm. Simple γ band mixing was found to work, within experimental error for transitions from the γ band, however, the inclusion of β, γ band mixing could not bring agreement with experiment. For transitions from the β-band, both simple β band mixing and β, γ band mixing could not make the calculated ratios agree with experiment. The asymmetric rotation model of Davidson was also compared with experiment and the value of the deformation parameter γ and the softness parameter μ was found to be 11.1° and 0.396, respectively for ^{152}Sm. The asymmetric model was able to predict correctly the B(E2) ratios from the γ band but not from the β band. Monopole contributions in transitions from levels in the β band to levels of the same spin in the ground state were estimated and compared with the model predictions via "x" ratios. It was found that both models overestimated the amount of the EO contribution in these transitions. Some evidence has been found for a new 1293 keV level in ^{152}Sm. Eleven levels in ^{152}Gd were identified, seven of which could be identified to quasi-rotational bands. (Diss. Abstr. Int., B)

29099 DECAY OF ^{161}Gd(β^-,3.7 min)^{161}Tb. Gasser, M.; Huber, O.; Ionescu, V.; Kern, J.; Raemy, A. (Univ., Fribourg, Switzerland). Helv. Phys. Acta; 46: 58-59(1973).

Energy levels in ^{161}Tb populated in the β^- decay of ^{161}Gd have been calculated. In this work gamma spectra were measured from 10 to 2000 keV from decay of irradiated samples which were 99.999% pure. A number of new lines were seen, and new levels are reported at 496 and 707 keV. (RWR)

29100 UNIQUE β TRANSITION OF ^{166}Ho. Bogdan, D.; Cirjan, N.; Fuia, H. (Inst. of Atomic Physics, Bucharest). Bul. Inst. Politeh. Gheorghe Gheorghiu-Dej Bucuresti; 34: No. 3, 27-33 (1972). (In Rumanian).

The observables of the unique β transition $0^- \rightarrow 2^+$ of ^{166}Ho are calculated by using the independent quasi particle in the deformed Woods–Saxon potential. In calculating the observables, besides the main matrix element $\int_1 \beta_{1j}$, the following correction matrix elements are considered: $\int_1 \beta_j [(r/R)^2]$, the matrix element due to taking into consideration of the finite dimension of the nuclear charge: $\int \gamma_5 (R_{1j}/R_2)$ and $\int \gamma_5 (T_{1j}/R^2)$, due to the relativistic matrix elements of higher order. The comparison of the observables with the values experimentally obtained show a satisfactory agreement. (3 figures, 1 table) (auth)

29101 NUCLEAR LEVELS IN ^{160}Tb. Kern, J. (Univ., Fribourg, Switzerland); Mauron, G.; Michaud, B.; Schaller, L. A.; Koch, R.; Maier, B. P. K.; Breitig, D.; Schult, O. W. B.; Schreckenbach, K.; Egidy, T. v.; Mampe, W. Helv. Phys. Acta; 46: 60-61(1973).

A level scheme for ^{160}Tb accommodating over 80 low-energy transitions was constructed by using new and published data. Members of the low-lying rotational bands corresponding to the $\frac{3}{2}^+[411\uparrow]$ proton configuration are given, and spin–parity assignments are shown. (1 figure) (RWR)

29102 GROUND STATE ROTATIONAL BANDS IN ^{158}Dy, ^{160}Dy, AND ^{162}Dy. Ewan, G. T.; Andersson, G. I. (Chalk River Nuclear Labs., Ont.). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 155-163(1972).

Levels in the ground state bands of ^{158}Dy, ^{160}Dy and ^{162}Dy have been populated by (α,2n) reactions on metallic targets of separated ^{156}Gd, ^{158}Gd and ^{160}Gd isotopes. Two Ge(Li) detectors were used to study singles gamma-ray spectra, gamma-ray angular distributions, gamma–gamma coincidence spectra and relative yields of gamma-rays for bombarding energies from 20 to 27 MeV. Transitions from all levels in the ground state bands up to the 12^+ member were identified; and the following level energies in keV, established: ^{158}Dy: $0(0^+)$, $99.0(2^+)$, $317.4(4^+)$, $637.9(6^+)$, $1044.1(8^+)$, $1520.1(10^+)$ and $2049.4(12^+)$; ^{160}Dy: $0(0^+)$, $86.7(2^+)$, $283.7(4^+)$, $581.4(6^+)$, $967.4(8^+)$, $1429.0(10^+)$, $1951.7(12^+)$; ^{162}Dy: $0(0^+)$, $80.7(2^+)$, $265.7(4^+)$, $548.5(6^+)$, $921.1(8^+)$, $1374.8(10^+)$ and $1901.0(12^+)$. There is weak evidence for the 14^+ levels in ^{158}Dy and ^{160}Dy. The level energies are compared with calculated values using the variable moment of inertia model. (auth)

29103 LEVEL STRUCTURE OF ^{187}Os. Morgen, P.; Nielsen, B. S.; Onsgaard, J.; Soendergaard, C. (Royal Veterinary and Agricultural Univ. of Copenhagen). Nucl. Phys.; A204: No. 1, 81-96(1973).

A study of the level structure of ^{187}Os has been performed by means of (d,p), (d,t) and (d,d') reactions. Based upon the data presented and information available from the 10.5 h decay of ^{187}Ir, a level scheme including several new states and level assignments is proposed. The low-lying rotational bands built on the $\frac{1}{2}^-[510]$ and the $\frac{5}{2}^-[512]$ single-particle states have been analyzed by means of Coriolis-coupling calculations including attenuations of the coupling matrix elements. The calculations involve fits to energies, to neutron transfer cross sections and to ratios of B(E2) values. (auth)

29104 LEVEL STRUCTURE OF ^{184}W FROM THE β^- DECAY OF ^{184}Ta. Yates, S. W. (Purdue Univ., Lafayette, IN); Daly, P. J.; Johnson, N. R.; Aras, N. K. Nucl. Phys.; A204: No. 1, 33-52(1973).

Levels of ^{184}W populated in the decay of 8.7 h ^{184}Ta have been studied by a variety of experimental techniques. As a result of β- and γ-ray energy and intensity determinations and extensive $\beta-\gamma$ and $\gamma-\gamma$ coincidence measurements, a detailed ^{184}Ta decay scheme accommodating more than 99.5% of the decay intensity has been established. Intense β-ray groups of end-point energies 1165 ± 26 and 1123 ± 26 keV populate levels in ^{184}W at 1699 and 1746 keV, which de-excite predominantly to the 8.3 μs isomeric level at 1285 keV, recently identified as the $\frac{1}{2}^-[510]\nu$-$1\frac{1}{2}^+[615]\nu$ $K^\pi = 5^-$ band origin. The 1699 keV level also de-excites to members of a $\frac{1}{2}^-[510]\nu$-$\frac{7}{2}^-[503]\nu$ $K^\pi = 3^+$ band based at 1425 keV. New information about the properties of the γ-vibrational and K = 2 octupole bands in ^{184}W is presented and the possible configurations of the levels directly populated in the β^- decay are discussed. The configuration $\frac{7}{2}^+[404]\pi$-$\frac{5}{2}^-[512]\nu$ $K^\pi = 5^-$ is indicated for the ^{184}Ta ground state. (auth)

29105 SEARCH FOR ROTATIONAL FINE STRUCTURE IN THE NUCLEUS ^{184}Hg. Hornshoej, P. (Univ. of Aarhus, Denmark); Hansen, P. G.; Jonson, B.; Lindahl, A.; Nielsen, O. B. Phys. Lett.; 43B: No. 5, 377-379(5 Mar 1973).

One possible explanation for the anomalous isotope shifts of ^{183,185}Hg is the sudden occurrence of permanent quadrupole deformations. The α-particle decay of 25 s ^{188}Pb, however, does not show any rotational fine structure. It is interesting to consider the possibility that the nuclei $^{183-185}$Hg have "bubble" shape. (auth)

29106 DIRECTIONAL-CORRELATION MEASUREMENTS ON THE (631-137) keV $\gamma-\gamma$ CASCADE IN ^{186}Os. Narasimha Raju, M. L.; Jagam, P.; Reddy, B. V.; Sastry, D. L. (Andhra Univ., Waltair, India). Indian J. Pure Appl. Phys.; 10: No. 8, 632-633 (Aug 1972).

The (631-137) keV gamma–gamma directional correlation in ^{186}Os is measured with a sum-peak-coincidence scintillation spectrometer using both liquid and solid sources. The results indicate that there is no attenuation of the correlation in solid sources due to time-dependent perturbations. (auth)

29107 MEASUREMENT OF MAGNETIC MOMENTS OF EXCITED STATES IN ^{181}Ta, ^{152}Sm, AND ^{177}Hf. Nigam, A. K.; Bhattacharya, R. (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys.; 46: No. 10, 441-450(Oct 1972).

Using the perturbed angular correlation technique, magnetic moments of excited states of ^{181}Ta, ^{152}Sm and ^{177}Hf have been measured. The nuclear g-factor of the 482 keV $5/2^+$ state ($T_{1/2}$ = 10.79 ns) of ^{181}Ta has been measured with DDCA as well as DDRF methods. The values of the g-factor with DDCA and DDRF methods are g = 1.32 ± 0.03 and g = 1.33 ± 0.05 respectively. By IRF method the gyromagnetic ratios of the 122 keV 4^+ state ($T_{1/2}$ = ns) of ^{152}Sm and the 113 keV $9/2^-$ state ($T_{1/2}$ = 0.50 ns) of ^{177}Hf have been measured. The g-factor values of these states are given as follows: ^{152}Sm: g = 0.33 ± 0.05 and ^{177}Hf: g = 0.214 ± 0.032. (auth)

29108 (n,α) REACTIONS AT THERMAL ENERGIES. Alam, J.; Sehgal, M. L. (Aligarh Muslim Univ., India). Nucl. Phys.; A205: No. 3, 614-618(1973).

Cross section ratios $\sigma(n,\alpha)/\sigma(n,\gamma)$ at thermal neutron energies for the target nuclei ^{180}Hf, ^{203}Tl, ^{206}Pb and ^{209}Bi have been measured to be $(38.5 \pm 1.1) \times 10^{-3}$, $\leq 2.5 \times 10^{-3}$, $(15.4 \pm 1.7) \times 10^{-3}$ and $(4.4 \pm 0.4) \times 10^{-3}$ respectively. The activation technique was used for measuring these cross sections. (auth)

29109 MEASUREMENT OF THE ENERGY DISTRIBUTIONS OF FRAGMENTS DURING FISSION OF PRE-ACTINIDE NUCLEI BY ALPHA PARTICLES USING THE "TRACK METHOD." Itkis, M. G.; Okolovich, V. N.; Pavlov, A. F.; Rus'kina, G. Ya. At. Energ. (USSR); 34: No. 2, 133-135(Feb 1973). (In Russian).

In view of the disadvantages inherent in other methods of measuring fragment energies, the track method appears to be the most promising for nuclei whose fission mode is predominantly symmetric, and because the energy resolution is significantly narrower than for other methods. The track method was applied in the case of fissioning of ^{185}Re, ^{188}Os, ^{197}Au, and ^{209}Bi by 30-MeV α particles. These isotopes were deposited in the form of a film 100 to 200 $\mu g/cm^2$, and a photoemulsion served as a detector of fission fragments. Measurements were made of the energy distributions of fission fragments for the compound nuclei ^{189}Ir, ^{192}Pt, ^{201}Tl, and ^{213}At. (2 figures, 1 table) (KSW)

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Refer also to abstracts 27693, 28934, 28938, 28978, 29034, 29035, 29040, 29053, 29054, 29056–29060, 29067, 29078, 29090, 29108, 29109, 29181, and 29259.

29110 (IS-T-575) PHOTONEUTRON CROSS SECTIONS FOR BISMUTH-209. Kocimski, S. M. (Ames Lab., Iowa). Feb 1973. Contract W-7405-eng-82. 82p. Dep. NTIS $6.25.

Thesis.

A high efficiency Gd-loaded neutron-sensitive scintillator detector for photonuclear reactions was developed. The maximum neutron counting efficiency obtained was 82%. A new method for correcting the results for the γ-ray intensity instability was developed. A 2.55-g/cm^2 Bi target was bombarded with bremsstrahlung from the Iowa State University 70-MeV synchrotron. Reaction yields were obtained at bremsstrahlung endpoint energies between 9 and 58 MeV at 1 MeV intervals. Subsequently, the cross sections for the (γ,n), (γ,2n), (γ,3n) and (γ,4n) reactions of ^{209}Bi were extracted from the yield curves by the "least structure" technique. The following values were obtained for the sum rules: s_0 = 3954 mb-MeV, s_{-1} = 264 mb and s_{-2} = 16.6 mb/MeV. For the Lorentz parameters for the total photoneutron cross section the following values were obtained: σ_0 = 565 mb, E_r = 13.9 MeV, and Γ = 4.5 MeV. (auth)

29111 HIGH-ENERGY ALPHA AND HELIUM INELASTIC SCATTERING. Tatischeff, B.; Brissaud, I.; Le Bornec, Y.; Willis, N. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 151(1972).

Experimental results are presented for the scattering of 166-MeV alpha particles and 215-MeV ^{3}He by the first 3^- level of ^{208}Pb. (FR)

29112 NUCLEAR STRUCTURE EFFECT IN INTERNAL CONVERSION OF THE ISOMERIC TRANSITION IN ^{191}Os. Loeweneck, P.; Martin, B. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Nucl. Phys., A; A203: No. 2, 332-338(1973).

Measurements have been performed on relative conversion line intensities of the hindered 74.38 keV isomeric transition in ^{191}Os with the $\frac{1}{2}\pi\sqrt{13}$ iron-free β-ray spectrometer. Anomalies were observed for the L, M and N subshell intensity ratios and were explained with a nuclear structure parameter $\lambda = 9.4 \pm 0.5$ and a mixing ratio $|\delta(E4/M3)| = (3.0 \pm 0.3) \times 10^{-3}$. (auth)

29113 CENTROID-SHIFT MEASUREMENT OF THE MEAN LIFETIMES OF THE 316 AND 612 keV STATES OF ^{192}Pt. Smith, G. J.; Simms, P. C. (Purdue Univ., Lafayette, IN). Nucl. Phys.; A202: No. 2, 409-420(1973).

The mean lifetimes of the 316 and 612 keV levels in ^{192}Pt were measured by means of a new variation of the centroid-shift method. The technique uses a triple coincidence among a β-particle and two γ-rays. Values obtained for the lifetimes are $\tau(316) = 61.7 \pm 2.1$ and $\tau(612) = 38.2 \pm 2.2$ psec. The effect of these results on the analysis of the g-factors for these two states is discussed. (auth)

29114 $\beta-$(CIRCULARLY POLARIZED γ) CORRELATION IN THE DECAY OF ^{198}Au. Hartman, F. J.; Daniel, H. (Univ., Munich). Phys. Lett.; 43B: No. 4, 287-288(19 Feb 1973).

The $\beta-$(circularly polarized γ) correlation of ^{198}Au has been measured as a function of the β energy at two different angles between β particle and γ quantum. The results show a P_3 (cos θ) term to be present in the correlation and hence do not agree with the ξ approximation. (auth)

29115 PROBABILITY FOR α-DECAY OF ODD AND ODD–ODD SPHERICAL NUCLEI AND SUPERFLUIDITY. Martynov, A. A.; Kadmenskii, S. G. (Voronezh State Univ., USSR). Yadern. Fiz.; 17: No. 1, 75-80(Jan 1973). (In Russian).

In the framework of the non-R-matrix approach developed earlier, there are carried out calculations for absolute probabilities of α-decay for 108 odd and odd-odd isotopes of Ir, Pt, Au, Hg, Po, At, Rn, Fr, Ra, Ac, Th with the notion, that transition with the largest reduced width is more preferable. It is shown that the notion of the preferable α-decay for a majority of odd and odd-odd spherical nuclei is in accord with the experimental data. It has been found, that account for superfluid correlations results in increase of absolute probabilities for α-decay from 130 up to 3300 times and allows one to reach a qualitative agreement for the behavior of relative experimental and theoretical α-widths. Some theoretical predictions have been put forward for experimental data, unreliably measured. (auth)

29116 ALTERNATIVE METHOD TO STRUTINSKY PRESCRIPTION FOR DETERMINING NUCLEAR GROUND STATE SHELL CORRECTION. Ramamurthy, V. S.; Kataria, S. K.; Kapoor, S. S. (Bhabha Atomic Research Centre, Bombay). pp 189-193 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29117 EVIDENCE FOR THE PERSISTENCE OF SHELL EFFECTS ON THE SADDLE POINT DEFORMATION OF ^{201}Tl. Ramamurthy, V. S.; Kapoor, S. S. (Bhabha Atomic Research Centre, Trombay, India). pp 195-200 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29118 TRIPLE GAMMA ANGULAR CORRELATION STUDIES OF THE RADIATIONS FROM THE DECAY OF ^{192}Ir. Pande, U. S.; Singh, B. P. (Univ. of Roorkee, India). pp 401-406 of Proceedings of the Nuclear Physics and Solid State Physics Symposium,

Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29119 HALF-LIFE OF THE 208.1 keV TRANSITION IN ^{199}Hg AND THE INTERNAL CONVERSION COEFFICIENTS OF THE TRANSITIONS IN ^{199}Hg. Singh, H.; Sethi, B.; Tikku, V. K. (Saha Inst. of Nuclear Physics, Calcutta). pp 445–449 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29120 INTERACTION OF 13 TO 17 MeV NEUTRONS WITH Pb ISOTOPES. Benetskii, B. A.; Nefedov, V. V.; Frank, I. M.; Shtranikh, I. V. (Inst. of Nuclear Research, Moscow). Yadern. Fiz.; 17: No. 1, 21-23(Jan 1973). (In Russian).

The cross sections for neutron interactions with ^{206,207,208}Pb have been measured. A resonance peculiarity is observed in the behavior of the neutron total cross section for ^{207}Pb at neutron energy 16.7 MeV. (auth)

29121 GAMMA RAY ENERGY VS. PARTICLE ENERGY MEASUREMENTS. Browne, C. P. (Univ. of Notre Dame, IN). pp 15-25 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

Four excitation energies measured with charged-particle reactions are compared to excitation energies deduced from γ-decay energies. In two cases the Po-α energy scale is compared to the ^{198}Hg energy scale by measuring the excitation energy of a nuclear state with elastic and inelastic scattering of charged particles and with γ decay of that state to the ground state. In a third case spacings of energy levels deduced from particle measurements are used as calibrating energies for γ decay from a higher-lying state, and the result is compared to the energy difference measured with charged particles. The results based on the ^{210}Po-α energies and the ^{198}Hg γ energy agree within 0.03% and 0.05%, respectively. The consistency of energy scales commonly used in nuclear reaction measurements has been demonstrated, and excitation energies from particle and γ-ray measurements to a precision of approximately 0.03% or 1.5 keV in the Po-α energy have been deduced. (UK)

29122 ENERGY DETERMINATIONS IN MEDIUM AND HEAVY NUCLEI. Parkinson, W. C. (Univ. of Michigan, Ann Arbor). pp 38-53 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

An assessment is made of what can now be achieved in accuracy in atomic mass determinations with the new cyclotrons. Although many problems in accurate Q-value determinations are common to all laboratories, some are unique to each instrumentation. The 83-inch cyclotron facility at The University of Michigan, its instrumentation and calibration are given. It is suggested that it would be particularly useful if the mass-spectroscopy measurements could be extended to the region of ^{208}Pb with comparable accuracy. It would appear that the obtainable accuracy in Q-value measurements would make such work meaningful. (UK)

29123 γ-DECAY OF TWO-PARTICLE STATES IN ^{210}Bi. Canada, T. R. (Univ. of Pittsburgh); Eisenstein, R. A.; Ellegaard, C.; Barnes, P. D.; Miller, J. Nucl. Phys.; A205: No. 1, 145-167(1973).

The γ-decay of excited states in ^{210}Bi up to 3330 keV excitation energy has been studied using the ^{209}Bi(d,pγ)^{210}Bi reaction. From the observed decay scheme, tentative J^π values are made for 25 states. The excitation energies, (d,p) strengths and decay branching ratios of these states are compared with those calculated using the two-particle shell-model wave functions of Kim and Rasmussen and Kuo and Herling. (auth)

29124 MODEL-INDEPENDENT TECHNIQUE TO DETERMINE RELATIVE PROTON STRENGTHS OF ISOBARIC ANALOG STATES. Woods, T. J. (Univ. of Minnesota, Minneapolis). Phys. Lett.; 43B: No. 5, 383-385(5 Mar 1973).

The proton ($\tilde{p}$) decay of the isobaric analog state (IAS) of ^{208}Pb has been observed in coincidence with the IAS neutron from the (p,n) reaction of ^{208}Pb. Such a technique allows an accurate model-independent determination of the relative widths of the $\tilde{p}$ decay to the first three states of ^{207}Pb, and, in principle, a much more accurate determination of the relative widths than either resonance or non-coincidence $\tilde{p}$-measurements. (auth)

29125 HIGH-RESOLUTION STUDIES OF 17-MeV DEUTERON INDUCED REACTIONS ON MERCURY AND LEAD ISOTOPES. Moyer, R. A. Pittsburgh; Univ. of Pittsburgh (1972). 173p. University Microfilms Order No. 73-1645.

Thesis (Ph. D.).

Approximately 500 levels have been observed in the (d,p) and (d,t) reactions on ^{204}Hg, ^{202}Hg, ^{200}Hg, ^{198}Hg, the (d,d′) reactions on ^{207}Pb, ^{204}Hg, ^{202}Hg, ^{201}Hg, the (d,t) reactions on ^{208}Pb, and the (d,p) reactions on ^{206}Pb, ^{196}Pt, ^{194}Pt, and ^{natt}Pt at a bombarding energy of 17 MeV. The outgoing particles were detected on photographic plates in an Enge split-pole spectrograph. Over 200 angular distributions in the (d,p) and (d,t) reactions were measured and compared with distorted-wave-Born-approximation calculations to assign l values and extract spectroscopic factors. Among the many new levels observed in the mercury isotopes were two very low-lying levels — a $p_{\frac{1}{2}}$ at ~0.005 MeV in ^{203}Hg and a $f_{\frac{5}{2}}$ at ~0.028 MeV in ^{201}Hg. The (d,t) reaction only excites shell-model neutron-hole levels, while the (d,p) reaction excites shell-model neutron-particle levels above the N = 126 gap with greatest intensity in the heavier mercury isotopes. In the lighter mercury isotopes, the (d,p) reaction increasingly excites the neutron-hole states until in ^{199}Hg the neutron-hole states are excited with greatest intensity. Fragmentation of all the single-particle and single-hole levels is seen and tends to increase in the lighter mercury isotopes. In the lead studies, special emphasis was placed on obtaining accurate excitation energies to compare those states excited in more than one reaction. In ^{206}Pb(d,p), some of the two-hole-one-particle (2h-1p) states are found to be fragmented. The $i_{13/2}$ and $j_{15/2}$ 2h-1p states are tentatively identified. Many of the weaker (less than 5 μb/sr) transitions in (d,t) have angular distributions which do not follow DWBA — possibly indicating other than one-step reaction mechanisms. Observation of the 2h-1p states in the ^{208}Pb(d,t)^{207}Pb reaction indicates that the ^{208}Pb closed shell contains about 4.7% $(2g_{\frac{9}{2}})^2$, $\gtrsim$4.7% $(3d_{\frac{5}{2}})^2$, and $\gtrsim$1.2% $(4s_{\frac{1}{2}})^2$ particle-^{206}Pb core admixture. Only a few definite level assignments were made in ^{195}Pt and ^{197}Pt because of difficulties in associating transitions with the proper isotopes. However, for those levels which were assigned (including a new level at 0.099 MeV in ^{197}Pt, tentatively identified as $f_{\frac{5}{2}}$), spectroscopic factors were extracted and showed increased fragmentation over that seen in the mercury and lead isotopes. (Diss. Abstr. Int., B)

29126 DECAY OF ^{192}Ir. Gehrke, R. J. (Aerojet Nuclear Co., Idaho Falls, ID). Nucl. Phys.; A204: No. 1, 26-32(1973).

The decay of ^{192}Ir has been studied with Ge(Li) spectrometers. Gamma-ray energies and relative intensities are reported. Four previously unreported transitions at 329, 420, 593, and 703 keV have been identified by half-life and a level in ^{192}Os at 909 keV has been established on the basis of energy considerations. Upper limits are given for the γ-ray intensities of previously reported transitions at 110, 212, 280, 739, 765 and 1055 keV. (auth)

29127 SCATTERING OF 14.1 MeV NEUTRONS FROM ^{209}Bi. Matoba, M.; Hyakutake, M.; Tawara, H.; Tsuji, K.; Hasuyama, H.; Matsuki, S.; Katase, A.; Sonoda, M. (Kyushu Univ., Fukuoka). Nucl. Phys.; A204: No. 1, 129-137(1973).

Differential cross sections for the elastic and inelastic scattering of 14.1 MeV neutrons from ^{209}Bi have been measured with a time-of-flight system which had an energy resolution of 650 keV. For elastic scattering from ^{209}Bi, an optical-model analysis gave the best-fit potential parameters. The absolute cross sections for excitation of collective (2.66 and 4.36 MeV) states are reproduced by the results of distorted-wave calculations under the assumption of a core (^{208}Pb) excitation model using deformation parameters obtained from (p,p′) reactions. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 27480, 27656, 28913, 28934, 29003, 29034, 29035, 29056, 29058, 29059, 29115, 29116, 29157, 29158, 29171, 29197, 29215, 29249, and 29259.

29128 (COO–3058-29) LINEAR ACCELERATOR PROJECT PROGRESS REPORT FOR OCTOBER 1, 1972–DECEMBER 31, 1972. (Rensselaer Polytechnic Inst., Troy N. Y.). [nd]. Contract AT(11-1)-3058. 51p. Dep. NTIS $4.75.

Research on neutron cross sections, reactor physics, and engineering, and instrumentation development is summarized. (JFP)

29129 (FEI-328) MEASUREMENTS OF INTEGRAL ALPHA VALUES FOR ^{239}Pu AND ^{235}U. Dvukhsherstnov, V. G.; Kazanskii, Yu. A.; Furmanov, V. M. (Gosudarstvennyi Komitet po Ispol'-Zovaniyu Atomnoi Energii SSSR, Obninsk. Fiziko-Energeticheskii Institut). 1972. 15p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

The ratios of the capture-to-fission cross sections were determined for ^{239}Pu and ^{235}U by using a neutron beam from the reactor at the Obninsk power station and different thicknesses of a ^{10}B absorber. The results were compared with values of alpha obtained from computation by the 26-group system (BNAB-26) and with data from differential measurements (ORNL-RPI, Harwell, Otsenka, ORELA). The values of alpha from the integral experiment were 0.43 for ^{239}Pu and 0.37 for ^{235}U. (2 figures, 3 tables) (KSW)

29130 (FRNC-TH-337) STUDY OF VERY NEUTRON RICH Na AND K NUCLEI PRODUCED IN HIGH ENERGY NUCLEAR REACTIONS USING ON-LINE MASS SPECTROMETRY. Rigaud, C. (Paris Univ., Orsay (France)). 1972. 92p. (In French). Dep. NTIS (U. S. Sales Only) $6.75.

Thesis.

On-line mass spectrometry was used to study the alkali nuclei produced in the p + U reaction at 24 GeV. The existence of the ^{32}Na and ^{33}Na isotopes and the ^{48}K, ^{49}K, ^{50}K isotopes was demonstrated. The lifetimes of these isotopes were measured and the lifetime of the ^{31}Na isotope was estimated. A shell effect was observed in the systematic analysis of the cross sections corresponding to the production of the Na and K isotopes. For the first time, direct measurements were made of the masses of the ^{27}Na, ^{28}Na, ^{29}Na, and ^{30}Na isotopes using-on-line mass spectrometry. Systematic differences occur between the experimental results and the theoretical predictions. (France)

29131 (FRNC-TH-341) STUDY OF AN INTERMEDIATE STRUCTURE IN THE ^{237}Np FISSION CROSS SECTION. Paya, D. (Paris Univ., Orsay (France)). 1972. 139p. (In French). Dep. NTIS (U. S. Sales Only) $9.00.

Thesis.

The fission of nonfissile ^{237}Np nucleus was studied for a large number of resonances. It was possible to identify and analyze about 250 resonances. Prior to these studies, only the $2g\,\Gamma_n$ product was known for about 30 of these levels. The increased resolution does not enable all the levels to be observed, however it does permit macroscopic results to be given with a fairly good degree of reliability e.g., value of the density function. In studies of the fission cross section beneath the threshold an intermediate structure is to be observed. It was shown that this structure is not due to the entrance channel states but is connected with the fission mechanism. The double-humped Strutinski potential predicts the possible existence of levels in the second well thus explaining the intermediate structure. The levels situated in the second well behave as compound nucleus levels in the first well and it is possible to class them in two families characterized by the values of their angular momenta. Direct observation of these levels is difficult. It seems likely, however that one of these levels was observed at about 40 eV. The experimental results obtained permitted the double-humped fission barrier parameters to be obtained. (France)

29132 (FRNC-TH-351) SPECTROSCOPIC STUDY OF THE ^{234}Th → ^{234}Pa → ^{234}U DECAY CHAIN. Godart, J. (Grenoble Univ. (France)). 1972. 101p. (In French). Dep. NTIS (U. S. Sales Only) $7.25.

Thesis.

The level scheme of ^{234}Pa resulting from the β disintegration of ^{234}Th was studied. Particular interest was given to the 1^- levels at 92.38 and 103.35 keV: the introduction of a Coriolis coupling enabled the M_1 transition probability ratios detected between these levels to be explained. The 1^+ levels at 92.8 and 112.80 keV and the 2^+ levels at 132.93 and 184.8 keV are probably not interpretable in terms of a single coupling of individual configurations but by two or more such couplings. The problem of ^{234}Pa isomers is discussed. It was also possible to predict and define a number of levels of the ^{234}U nucleus. (FR)

29133 SEARCH FOR FISSION ISOMERS WITH ^{14}N AND ALPHA PARTICLE REACTIONS. Eastham, D. A.; Grant, I. S. (Univ. of Manchester, Eng.). J. Phys. (Paris), Colloq.; No. 5, 9(1972).

Spontaneously fissioning isomers produced by the reaction of α particles and ^{14}N ions on natural thorium targets were sought. No fissioning isomers were observed from the α reactions on ^{232}Th. An isomer previously observed in ^{242}Bk from the ^{241}Am$(\alpha,3n)^{242}$Bk reaction was not seen in the ^{14}N reaction. (FR)

29134 MEASUREMENT OF THE ENERGY LOSS IN ARGON OF FISSION FRAGMENTS HAVING SELECTED MASSES. Bertin, A. (Univ., Bologna); Bruno, M.; Vannini, G.; Vitale, A.; Forte, M. Phys. Lett.; 43A: No. 3, 231-233(12 Mar 1973).

The energy losses of fission fragments from ^{252}Cf were measured, selecting their masses, along their range in argon. The results are discussed normalizing the fragment kinetic energies to the same initial value. (auth)

29135 ISOMERIC TWO-PARTICLE STATE IN ^{236}U. Brinckmann, H. F.; Clark, D. D.; Hansen, N. J. S.; Pedersen, J. (Univ. of Copenhagen). Phys. Lett.; 43B: No. 5, 386-388(5 Mar 1873).

A new isomeric state with 125 ± 20 ns half-life has been found in a ^{235}U(d,pγ)^{236}U experiment. Of the 12 observed delayed γ-lines, 11 have been fitted into a tentative decay scheme. The isomeric level is deduced to be the $K,J^\pi = 4,4^-$ two-quasineutron state at 1052 keV with configuration $[743]7/2^-$; $[631]1/2^+$ that is also seen in (d,p) experiments. (auth)

29136 NUCLEAR MODELS APPROACH TOWARDS SUPER-HEAVY ELEMENTS. Sood, P. C. (Banaras Hindu Univ., Varanasi, India). pp 65-92 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

29137 HALF-LIFE MEASUREMENT OF ^{252}Cf. Mijnheer, B. J.; van den Hauten-Zuidema, E. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Int. J. Appl. Radiat. Isotop.; 24: No. 3, 185-187(Mar 1973).

The half-life of a standard ^{252}Cf fission neutron source was measured by following the decay of the neutron emission of the source by means of a manganese bath system over a period of 1982 days during which 17 data points were obtained. The half-life was found to be (2.659 ± 0.010) yr. Sources of error are discussed. This figure is in reasonable agreement with that of (2.646 ± 0.004) yr of Metta et al. (J. Inorg. Nucl. Chem.; 27: 33(1965)), but it differs from that of (2.621 ± 0.006) yr of De Volpi (Inorg. Nucl. Chem. Lett.; 5: 111 (1969)), and reasons are discussed. (UK)

29138 CONSTRAINED HARTREE-FOCK CALCULATIONS OF ^{240}Pu. Flocard, H.; Quentin, P.; Vautherin, D. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 5, 3(1972).

Hartree-Fock-Skyrme calculations were performed for the ^{240}Pu nucleus. A quadratic constraint was introduced in the deformation energy curve and the residual pairing interaction was taken into account. Solutions with axial symmetry and reflexion symmetry with respect to the equatorial plane were considered. (FR)

29139 KINETICS OF POPULATION FOR THE FISSION SPIN ISOMERS. Vilcov, N. (Kansas State Univ., Manhattan). Rev. Roum. Phys.; 17: No. 6, 739-745(1972).

A number of recent experiments refer to the double fission isomer study. An analysis of the double fission isomer population kinetics is given. Some limit cases of practical use are considered. (auth)

29140 NUCLEAR PHYSICAL CONSTANTS FOR THE TRANSURANIUM ELEMENTS. II. Kon'shin, V. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 3, 28-36(1972). (In Russian).

A review and analysis of available experimental data for thermal fission cross sections, thermal capture cross sections as well as resonance integral data for capture and fission of ^{245}Cm are given. Respective data for those values are recommended. (auth)

29141 MEASURING THE EFFECTIVE CROSS SECTIONS FOR ^{244,245,246,247,248}Cm ISOTOPE FISSION BY NEUTRONS OF FAST REACTOR. Fomushkin, E. F.; Gutnikova, E. K.; Maslennikov, B. K.; Korochkin, A. M. Yadern. Fiz.; 17: No. 1, 24-27(Jan 1973). (In Russian).

Effective cross sections for $^{244-248}$Cm nucleus fission by neutrons of the fast reactor have been measured with dielectric detectors. The cross sections turned out to be equal to 1.28 ± 0.04; 2.01 ± 0.20; 0.87 ± 0.03; 1.91 ± 0.11 and 0.93 ± 0.06 b respectively. Some peculiarities of fissioning of these nuclei are being discussed. (auth)

29142 ENERGY AND ANGULAR DISTRIBUTIONS OF LONG RANGE CHARGED PARTICLES IN THERMAL FISSION OF ^{235}U. Nadkarni, D. M.; Kataria, S. K.; Kapoor, S. S.; Rama Rao, P. N. (Bhabha Atomic Research Centre, Trombay, India). pp 45-52 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29143 STUDIES ON HIGHLY ASYMMETRIC BINARY FISSION: FISSION OF URANIUM WITH REACTOR NEUTRONS. Rao, V. K.; Bhargava, V. K.; Marathe, S. G.; Sahakundu, S. M.; Iyer, R. H. (Bhabha Atomic Research Centre, Trombay, India). pp 53-59 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29144 SEARCH FOR SUPERHEAVY ELEMENTS IN NATURAL MATERIALS. Trivedi, B. M. P. (Indian Inst. of Tech., Kanpur). pp 183-188 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29145 FURTHER CALCULATIONS ON THE DISTRIBUTION OF FRAGMENT MASS AND CHARGE IN FISSION. Ramamurthy, V. S. (Bhabha Atomic Research Centre, Trombay, India). pp 201-205 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29146 LOW-LYING ENERGY LEVELS OF ^{178}Hf, ^{233}Th, AND ^{239}Pu. Ramana Murty, M. V.; Ramamurty, S.; Parthasaradhi, K. (Andhra Univ., Waltair). pp 319-322 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29147 ALPHA-GAMMA DIRECTIONAL CORRELATION IN A POLYCRYSTALLINE ^{241}Am SOURCE. Garg, R. K.; Chauhan, S. D.; Gupta, S. L.; Saha, N. K. (Univ. of Delhi). pp 369-373 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29148 DECAY OF ^{239}Np TO ^{239}Pu. Gopinathan, K. P.; Agnihotry, A. P.; Tandon, P. N.; Jain, H. C.; Patel, S. B. (Tata Inst. of Fundamental Research, Bombay). pp 395-400 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29149 RECENT MINNESOTA MASS RESULTS. Kayser, D. C.; Britten, R. A.; Johnson, W. H. (Univ. of Minnesota, Minneapolis). pp 172-179 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Results are reported for the masses of ^{235}U, ^{238}U and ^{232}Th and compared with the 1967 mass table, from which it is seen that the presently reported values are about 20 $\mu\mu$ lower. A study has been made and is reported of the feasibility of mass measurements of short-half-life radioactive isotopes. Lastly, a development of a new technique for peak matching which may be used with only partially resolved doublets is given. (UK)

29150 FISSION CROSS SECTION OF NEPTUNIUM-237. Jiacoletti, R. J. Fort Collins, CO; Colorado State Univ. (1972). 106p. University Microfilms Order No. 73-2797.

Thesis. (Ph. D.).

The ^{237}Np(n,f) cross section was measured from 20 eV to 7 MeV, including the range where no data previously existed (4 to 24 keV). Energies of the source neutrons from the Physics 8 underground nuclear explosion were determined by measuring the time of flight from the source to the neptunium target foil. The current signals produced in solid-state detectors by fission fragments were photographically recorded and converted to cross sections using the neutron flux measured with ^{238}U(n,f) and ^{6}Li(n,α)T reactions. Subthreshold resonances were observed in the ^{237}Np(n,f) cross section. The maximum value of the cross section observed just above threshold is 1.9 barns at 2.26 MeV. A comparison of results with some previously reported values is presented. The data are applied to some reported threshold or integral detector results which show a significant discrepancy between the observed or measured and the computed spectral index for the Neptunium-237/Uranium-238 detector pair. A correction factor produced with this measured fission cross section resolves the discrepancy noted in two fast-fission neutron spectra. (Diss. Abstr. Int., B)

29151 NEW RESULTS ON SUPERHEAVY ELEMENTS. Nachr. Chem. Tech.; 20: No. 22, 456-457(1972).

A brief survey on the production of superheavy elements by means of heavy-ion bombardment of uranium, particularly the bombardment of ^{238}U with ^{136}Xe ions in the combined system of the Dubna accelerators, is given; the decay and structural properties of the resulting nuclei are also discussed. (2 figures) (GF)

29152 DECAY OF ^{248}Cf. Hulet, E. K.; Wild, J. F. (Univ. of California, Livermore). Radiochem. Radioanal. Lett.; 13: No. 3, 217-220(3 Apr 1973).

A value of 333.5 ± 2.8 d has been determined for the total half-life of ^{248}Cf by long-term counting in ionization chambers. The alpha-to-spontaneous fission disintegration ratio was measured and from this a spontaneous fission half-life of $(3.2 \pm 0.3) \times 10^4$ y was calculated. A value of 0.170 ± 0.005 was measured for the fraction of ^{248}Cf alpha decays proceeding to excited levels in ^{244}Cm. (auth)

29153 DE-EXCITATION OF PRIMARY FISSION FRAGMENTS FROM THE NEUTRON-INDUCED FISSION OF ^{235}U. Khan, T. A.; Hofmann, D.; Horsch, F. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Phys.; A205: No. 3, 488-512(1973).

Two separate three-dimensional experiments have been performed in which the energies of coincident fragment pairs and γ-rays of internal conversion electrons, emitted within ≈1.6 nsec of the thermal-neutron-induced fission of ^{235}U, were recorded event by event. The fragment kinetic energies were used for mass identification. The self-consistency of the values of electron energy, γ-ray energy and fragment charge, and its agreement with x-ray selection data, were used to identify the atomic numbers of the fragments. The analysis of the γ-ray and conversion electron spectra resulted in the assignment of many transitions to new isotopes as well as improvement in or confirmation of many assignments from the ^{252}Cf spontaneous fission data. Limited information on the multipolarities of the transitions in even nuclei is presented. The relative yield of electrons per fragment indicates softness of deformation in the mass region 100-110. Data are presented supporting the assignment of a 193 keV transition as the $2^+ \rightarrow 0^+$ transition in ^{98}Sr. An examination of the $2^+ \rightarrow 0^+$ level systematics of neighboring even nuclei suggests a transition from vibrational to rotational behavior in the light fragments between neutron numbers 58 and 60. (auth)

29154 TERNARY FISSION OF ^{235}U INDUCED BY THERMAL NEUTRONS. Antanasijevic, R.; Juric, M.; Gerc, V. (Inst. of Physics, Belgrade). Fizika (Zagreb); 4: No. 4, 245-250(Dec 1972).

An investigation has been made of the ternary fission of ^{235}U in nuclear emulsions and solid state track detectors sensitive to particles of $A > 4$ and $A \geq 16$, respectively. The uranium target was homogeneously distributed throughout the emulsion, or vacuum evaporated on the two foils of the solid state detector (polycarbonate). On the basis of calculated ternary events and cases of scattering from the ternary fission a comparison is made of the results obtained by means of the two detectors. The yield of ternary fission relative to binary fission is determined to be (8.0 ± 0.4) 10^{-5} in the emulsion, and (7.4×0.2) 10^{-5} in the polycarbonate detector. (auth)

29155 AVERAGE NUMBER OF NEUTRONS RELEASED IN THE SPONTANEOUS FISSION OF ^{244}Cm, ^{246}Cm, AND ^{248}Cm. Golushko, V. V.; Zhuravlev, K. D.; Zamyatnin, Yu. S.; Kroshkin, N. I.; Nefedov, V. N. At. Energ. (USSR); 34: No. 2, 135-136(Feb 1973). (In Russian).

The values of $\bar{\nu}_p$, the average number of prompt neutrons generated by fission, were measured for the spontaneous fission of the even-even isotopes of Cm. The values of $\bar{\nu}_p$ previously obtained by other workers were compared with those obtained in the present work: ^{244}Cm-2.680; ^{246}Cm-2.927; ^{248}Cm-3.173. (2 tables) (KSW)

29156 MEASUREMENT OF THE RATIO OF EFFECTIVE FISSION CROSS SECTIONS $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$ USING SOLID TRACK DETECTORS. Malykhin, A. P.; Zhuk, I. V.; Churkin, Yu. I.; Yaroshevich, O. I. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 5-10(1972). (In Russian).

Technique and results of precise measurements of the effective fission cross-section ratio $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$ in a hard neutron spectrum by the solid state track detectors are described. Solid state track detectors were used with the pre-etched cover of silicate glass

of ~0.15 mm thickness. Thermal calibration measurements were made in the thermal column of the RRT-2000 reactor. Accuracy better than 1% of $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$ was achieved. The sources of systematic errors are discussed. (1 figure) (auth)

29157 NUCLEAR-PHYSICS CONSTANTS FOR TRANSPLUTONIUM ELEMENTS. I. Kon'shin, V. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 17-23(1972). (In Russian).

A tabulation and analysis of available experimental data for ν_p^{th} and ν_p^{sf} are presented for 25 target nuclei from ^{229}Th to ^{253}Fm. The scheme of successive neutron capture and β decay for production of ^{252}Cf from ^{239}Pu is outlined. (39 references) (1 figure, 1 table) (KSW)

Nuclear Theory

Refer also to abstracts 28624, 28719, 28948, 28965, 28974, 29027, and 29036.

29158 (CONF-720221-(Vol. 14A)) PROCEEDINGS OF THE NUCLEAR PHYSICS AND SOLID STATE PHYSICS SYMPOSIUM, BOMBAY, FEBRUARY 1–4, 1972. Volume 14A. Invited Talks. (Department of Atomic Energy, Bombay (India). Physics Committee). 1972. 185p.

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972).

The papers in this proceeding are title listed in this issue of NSA. (CES)

For titles of individual papers see: 27766, 28809, 28810, 29019, 29136, and 29183.

29159 (CONF-721066-1) PEDESTRIAN APPROACH TO THE INTERMEDIATE STRUCTURE IN PHOTONUCLEAR REACTION IN LIGHT NUCLEI. Malik, F. B.; Mustafa, M. G. (Indiana Univ., Bloomington. Dept. of Physics; Oak Ridge National Lab., Tenn.). 1972. 57p. Dep. NTIS.

From 5th symposium on the structure of low medium mass nuclei; Lexington, Kentucky, United States of America (USA) (27 Oct 1972).

A physical picture of the photonuclear reaction is first discussed. Although it is customary to classify photonuclear reactions as either direct reactions or compound processes, in actuality a physical situation may occur that cannot be adequately idealized by either of these two extreme models, and demands an intermediate approach blending salient features of both. The significance of processes of this type is examined. The next step is to find a mathematical language to implement the physical picture. Feshbach's approach (Ann. Phys. (N. Y.); 5: 357(1958); 19: 287(1962) is applied to the total Hamiltonian, but the explicit use of projection operators is avoided and a theory based on Trefftz's treatment of diaelectronic recombination (Z. Astrophys.; 65: 299(1967)) is adopted. Although cast specifically for photonuclear reactions, the theory can be applied to other cases, such as fine structure in analog resonances. Approximations used for the final-state wave function are discussed for direct reactions, bound-state calculations, continuum-state calculations, and the intermediate-coupling approximation. The formal solution of the coupled equations in the intermediate-coupling approximation is given. An expression for the cross section is written down. The case of one intermediate state, the case of overlapping resonances and many intermediate states, and the model of Duke, Malik, and Firk (Phys. Rev., 157: 879(1967)) are considered. Finally, the situation regarding the photonuclear reaction in ^{16}O is discussed in detail within the context of an intermediate structure treatment, and advances made for ^{12}C and ^{28}Si are mentioned. For the first two nuclei especially, an effective charge was used for all neutrons; this may be indicative of a serious drawback of using spherical shell model states as a basis. (16 figures) (RWR)

29160 (CONF-730312-2) SOME ASPECTS OF THE DWBA AS APPLIED TO HEAVY-ION REACTIONS. Satchler, G. R. (Oak Ridge National Lab., Tenn.). 1973. 15p. Dep. NTIS $3.00.

From symposium on heavy-ion transfer reactions; Argonne, Illinois, USA (15 Mar 1973).

Even though the DWBA (as usually understood) is applicable to reactions only if the transition is predominantly a one-step (first-order) process, its application to heavy-ion reactions is a rapidly developing field. In this connection the author defines some terminology, outlines the formalism, and comments on a few features of current interest. If one works in the "no-recoil" approximation, zero-range DWBA codes may be used to evaluate the expression for the amplitude, even though this does not involve a zero-range approximation. However, the no-recoil approximation can easily cause large errors in the phases of the distorted waves. Angular momentum selection rules determined by the nuclear matrix element or transfer function are given. For single-nucleon transfer, the shape of the tail of the transfer function is largely determined by the separation energies; however, its magnitude depends upon the short-range behavior of the bound-state wave function and the interaction. It is at this point that the simple picture of an inert core plus an active nucleon may not be adequate, and the problems involved are exacerbated when several nucleons are transferred. In particular, when one is dealing with the transfer of a cluster like an "alpha particle," it is tempting to think of the cluster as having an independent structure like that of a free alpha while the transfer takes place; this procedure allows one to assign a definite form to the wave function for the center of mass of the cluster, but it is almost certainly wrong, and to an unknown degree. (2 figures) (RWR)

29161 (FRNC-TH-312) NUCLEAR DENSITIES AND REACTIONS AT HIGH ENERGIES. Auger, J. P. (Paris Univ., Orsay (France)). 1971. 62p. (In French). Dep. NTIS (U. S. Sales Only) $5.25.

Thesis.

The analysis of high-energy reactions using the Glauber approximation leads to an expression, for the scattering cross section, in which the principal term is the product of the elementary cross section (nucleon reaction) and N(A), a number representing the effective number of nucleons participating in the reaction. It is shown that the function N(A) is more sensitive to the radius than to the thickness of the surface representing the nuclear density distribution. The effective number of nucleons participating in the formation of a pion is then calculated for proton–nucleus interactions, semi-self-consistent methods being used: formulas derived from the Brueckner energy density formalism and the Saxon–Woods density method (shell-model calculations in which the generalized Saxon–Woods potential due to Beiner is used). These densities permit the experimental values to be reproduced. The total nucleon–nucleus cross section is also calculated. (FR)

29162 (INP-811) LONGITUDINAL SUM RULE FOR INELASTIC ELECTRON SCATTERING AND NUCLEON–NUCLEON CORRELATIONS. Malecki, A.; Picchi, P. (Institute of Nuclear Physics, Krakow (Poland)). Oct 1972. 16p. Dep. NTIS (U. S. Sales Only) $3.00.

We have considered the influence of short-range dynamical and statistical correlations on the inelastic scattering of electrons from light nuclei. The correlation effects are discussed on the example of the longitudinal sum rule for the ^{16}O and ^{12}C nuclei. A remarkable increase in the sum rule, caused by the short-range correlations at medium momentum transfers (100 to 200 MeV), is pointed out. (auth)

29163 (JUL–893-KP) INVESTIGATION OF THE INTRUDER STATES AND ROTATIONAL STRUCTURE IN THE HARTREE–FOCK MODEL. Meinhart, M. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Kernphysik). Oct 1972. 67p. (In German). Dep. NTIS (U. S. Sales Only) $5.50.

Nuclear structure was studied with Hartree–Fock calculations. The positions of the first excited 0^+ states were described with the excitation of four particles in deformed orbitals of the s–d shell. From the axial symmetric, deformed solutions of the HF equations, the components with good angular momentum were projected according to the method of Peieris and Yoccoz. As effective NN interaction, the G-matrix elements of the Yale potential were used. (HBG)

29164 ISOTENSOR MUON CAPTURE IN NUCLEI. Shuster, M. D.; Rho, M. (CEN de Saclay, Gif-sur-Yvette, France). J. Phys. (Paris), Colloq.; No. 5, 143(1972).

The mechanisms involved in the interactions $\mu^- + p + p \rightarrow e^+ + n + n$ are discussed. (FR)

29165 ORTHOGONAL TRANSFORMATIONS OF MULTIDIMENSIONAL ANGULAR HARMONICS. Smorodinskii, Ya. A.; Efros, V. D. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 17: No. 1, 210-224(Jan 1973). (In Russian).

It is useful to have matrix elements (m.e.) of particle permutation operators between hyperspherical functions of specific form for solution of the problem of several nucleons with the method of hyperspherical expansion. Such m.e. coincide with m.e. of multidimensional (pseudo) rotations at some angles in the Jacoby vector space. The corresponding m.e. for A particles may consecutively be reduced to the m.e. of (pseudo) rotations, which act on three-particle hyperspherical functions. The latter m.e. are studied. Explicit formulas, recursion formulae, the relations of symmetry and a formula, expressing these m.e. through Talmy coefficients have been obtained. A method of calculating the m.e. by diagonalizing the matrices is presented. (auth)

29166 DYNAMICAL RECOIL EFFECTS IN A DISTORTED-WAVE TREATMENT OF HEAVY-ION TRANSFER REACTIONS. Gross, D. H. E. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). Phys. Lett.; 43B: No. 5, 371-374(5 Mar 1973).

The classical conditions of optimum particle transfer in heavy-ion reactions are shown to follow from a quantal distorted wave theory. To that purpose the method of three dimensional time dependent JWKB approximation is used. (auth)

29167 LONGITUDINAL SUM RULE FOR INELASTIC ELECTRON SCATTERING AND NUCLEON–NUCLEON CORRELATIONS. Malecki, A. (Inst. of Nuclear Physics, Krakow); Picchi, P. Phys. Lett.; 43B: No. 5, 351-354(5 Mar 1973).

We have considered the influence of short-range dynamical and statistical correlations on the inelastic scattering of electrons from light nuclei. The correlation effects are discussed on the example of the longitudinal sum rule for the ^{16}O and ^{12}C nuclei. A remarkable increase in the sum rule, caused by the short-range correlations at medium momentum transfers (100 to 200 MeV), is pointed out. (auth)

29168 REGGE POLES AND BACKWARD ELASTIC α-PARTICLE SCATTERING FROM ^{16}O. Ceuleneer, R.; Michel, F. (State Univ., Mons, Belg.). Phys. Lett., B; 43B: No. 5, 365-367 (5 Mar 1973).

The experimental angular distributions of α-particles scattered from ^{16}O energies around 20 and 29 MeV are analyzed using a two-Regge-pole representation. The spins of the observed resonances are extracted. (auth)

29169 EFFECTIVE INTERACTIONS IN THE PROTON OPTICAL-MODEL POTENTIAL. Thomas, G. L.; Sinha, B. C.; Duggan, F. (King's Coll., London). Nucl. Phys., A; A203: No. 2, 305-331(1973).

A six-parameter optical model is developed in which the real central part is calculated by folding several effective nucleon-nucleon interactions into matter distributions which reproduce single-particle binding energies and electron scattering data. A simple local approximation is made to take into account the exchange term. It is concluded that the density-dependent effective interactions derived from nuclear-structure calculations are also appropriate for nucleon-nucleus scattering. Off-shell effects are apparent from the worsening of the quality of fit for light nuclei. (auth)

29170 LIQUID-DROP DESCRIPTION OF THE NUCLEAR EXCITATION ENERGY. Stocker, W.; Burzlaff, J. (Univ., Garching, Ger.). Nucl. Phys.; A202: No. 2, 265-273(1973).

An extended Fermi-gas model is presented to describe volume, surface and asymmetry contributions to the nuclear excitation energy. The potential part of the nuclear energy is treated within Brueckner's energy-density formalism; appropriate corrections due to surface and asymmetry effects are included. An excited nucleus is interpreted as a metastable superheated liquid. The excitation energy as a function of the temperature is given by a sum of volume, surface and asymmetry terms. The corresponding level-density formula is in reasonable agreement with experimental values for a suitable choice of the nuclear incompressibility modulus. It is shown that the surface contribution is appreciable. (auth)

29171 MOMENT OF INERTIA AND THE ENERGY GAP OF FISSION ISOMERS. Sobiczewski, A. (Univ. of Copenhagen); Bjoernholm, S.; Pomorski, K. Nucl. Phys.; A202: No. 2, 274-288(1973).

The moments of inertia and the energy gaps of protons and neutrons have been calculated within the pairing formalism with Nilsson wave functions for different prolate shapes of doubly even nuclides from radium to curium. Two different assumptions—a constant pairing strength G = const, and one that increases proportionally to the surface area $G \propto S$—are investigated. The results are compared to available data for the ordinary ground-state shapes and for the shapes of the second minimum associated with fission isomers. The calculations account for the experimental results in the second minimum as well or even better than for the ground-state minimum. They support the theoretical description of the isomers as prolate shapes with a ratio of axes of about 1 : 2. The experimental data are not sufficiently accurate or numerous to decide which of the two assumptions about the pairing strength is the more realistic one. (auth)

29172 POSSIBILITY OF THE OPTICAL SEPARATION OF THE ISOMERIC NUCLEI BY LASER RADIATION. Letokhov, V. S. (Inst. of Spectroscopy, Moscow). Opt. Commun.; 7: No. 1, 59-60 (Jan 1973).

The possibility of using laser radiation for fast optical separation of isomeric nuclei is considered. The proposed method of separation is based on selective two-step photoionization of atoms or photodissociation of molecules. (auth)

29173 ESTIMATE OF THE BRANCHING TO THE EXCITED 0^+ STATE IN ^{42}Ca IN THE β^+-DECAY OF ^{42}Sc. Towner, I. S. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Lett.; 43B: No. 4, 267-270(19 Feb 1973).

The β^+-branch of the decay of the ^{42}Sc 0^+ ground state to the 1.836 MeV 0^+ state in ^{42}Ca is estimated in a simple Coulomb mixing model, which relates this branch to Coulomb displacement energies in 0^+ isotriplets and off-diagonal Coulomb matrix elements. The estimates obtained are very small, $\approx 10^{-4}$, which is consistent with current experimental data. (auth)

29174 FINITE-MOMENTUM-TRANSFER TEST OF CVC IN THE A = 12 SYSTEM. Kubodera, K.; Kim, C. W. (CEN de Saclay, Gif-sur-Yvette, France). Phys. Lett.; 43B: No. 4, 275-278(19 Feb 1973).

A finite-momentum-transfer test of CVC is given by analyzing the latest experimental data in the A = 12 system in the elementary particle treatment of nuclei. The test is completely model independent and is based on the fact that nuclear form factors are relatively rapidly varying functions of q^2. It is shown that the electromagnetic and weak nuclear form factors in the A = 12 system have, as predicted by CVC, the same q^2 dependence within $\approx 6\%$, at least up to $q^2 \approx m_\mu^2$. (auth)

29175 SHIFTS OF THE PEAKS IN PION–NUCLEUS SCATTERING NEAR THE $\Delta(1231$ MeV) AND A NEW EFFECTIVE OPTICAL POTENTIAL. Barshay, S.; Rostokin, V.; Vagradov, G. (Univ. of Copenhagen). Phys. Lett.; 43B: No. 4, 271-274(19 Feb 1973).

We present a different kind of calculation of a complex index of refraction or equivalently, a complex effective optical potential, for pion-nucleus scattering near the first pion–nucleon resonance where the elementary interaction is strong and varying with energy. Therefore certain dynamical effects of the medium upon the potential become important. (auth)

29176 α-PARTICLE EMISSION AND THE ORTHODOX INTERPRETATION OF QUANTUM MECHANICS. Maxwell, N. (University Coll., London). Phys. Lett.; 43A: No. 1, 29-30 (12 Feb 1973).

It is argued that Robinson's attempt to show that α-particle emission contradicts orthodox quantum mechanics does not succeed. However, the possibility remains that α-emission does contradict quantum mechanics. (auth)

29177 CALCULATIONS OF NEUTRON EVAPORATION FROM ^{252}Cf FISSION FRAGMENTS BASED ON THE SHELL MODEL. Nardi, E.; Moretto, L. G.; Thompson, S. G. (Univ. of California, Berkeley). Phys. Lett.; 43B: No. 4, 259-262 (19 Feb 1973).

The average neutron kinetic energies and the residual total gamma ray energies as a function of fragment mass are calculated for the spontaneous fission of ^{252}Cf on the basis of the Nilsson model and of the B. C. S. Hamiltonian. (auth)

29178 ADVANCES IN NUCLEAR PHYSICS. VOLUME 5. Baranger, M.; Vogt, E. (eds.). New York; Plenum Publishing Corporation (1972). 495p. $22.50.

Separate abstracts were prepared for each of the chapters in this volume. (RWR)

For abstracts of individual chapters see: 28915, 28948, and 29179.

29179 VARIATIONAL TECHNIQUES IN THE NUCLEAR THREE-BODY PROBLEM. Delves, L. M. (Univ. of Liverpool). Advan. Nucl. Phys.; 5: 1-224(1972).

The first part of this admittedly pedagogical paper discusses variation principles for bound states; the Rayleigh–Ritz principle, bound states of three bosons, and estimates of the accuracy of a variation calculation are considered. An explanation of numerical techniques ensues, including choice of trial function, the calculation of the normalization and Hamiltonian integrals, solution of the finite matrix equation, and control and analysis of round-off and integration errors. Bound-state calculations with realistic local potentials are then treated; reduction of the equations of motion, construction of the trial function, calculations in the harmonic oscillator basis, and calculations using hard-core potentials are discussed. Variational methods for scattering states are next described: two-body single-channel scattering, many-body two-particle scattering states, variation principles for many-body scattering states, neutron–deuteron elastic scattering, and alternate variational principles for the Schroedinger equation are included. Then variational methods for the Faddeev

equations are taken up; variational principle for inhomogeneous equations, the two-body t matrix, variational principle for the Faddeev equations, and alternative principles for the breakup reaction are presented. Convergence of variational methods is treated in an appendix. (41 figures, 16 tables, 217 references) (RWR)

29180 SCATTERING THEORY OF THREE-BODY SYSTEMS. Sasakawa, T. (Tohoku Univ., Sendai). Nucl. Phys.; A203: No. 3, 496-512(1973).

The Faddeev amplitude is expressed in the N/D form in terms of the real reciprocal matrix K. The S matrix is written in the unitary form $(1 + i\pi K)S = 1 - i\pi K$. The Breit-Wigner formula for the three-body system including the break-up channel is derived. In the present method, the three-body problem is reduced to solve the eigenvalue problem for the real symmetric kernel. (auth)

29181 SECOND-ORDER NUCLEON-NUCLEUS OPTICAL POTENTIAL. Sinha, B. (King's Coll., London). Nucl. Phys.; A203: No. 3, 473-480(1973).

The second-order nucleon-nucleus optical potential was calculated by using a simple second-order perturbation formalism. The results obtained by using an effective energy denominator indicate that the closure approximation is not valid for scattering. (2 figures, 1 table) (auth)

29182 SHELL EFFECTS IN A PAIRED NUCLEUS FOR FINITE EXCITATION ENERGIES. Jensen, A. S. (Nordita, Copenhagen); Damgaard, J. Nucl. Phys.; A203: No. 3, 578-596(1973).

Shell effects are considered as functions of the excitation energy of the nucleus. The effects of pairing are included and studied in the BCS approximation. Some numerical results, based on the single-particle spectrum of a Woods-Saxon potential, are given. In the limit of zero excitation the shell correction to the energy is compared with the results obtained by the Strutinsky method. (9 figures, 4 tables) (auth)

29183 SYMMETRY IN NUCLEAR PHYSICS. Parikh, J. C. (Physical Research Lab., Ahmedabad, India). pp 51-56 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

29184 REACTION THEORY OF COMPOSITE PARTICLES (CLUSTERS). Wildermuth, K. (Univ., Tuebingen, Ger.). Acta Phys. Austr., Suppl.; No. 9, 1-43(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972). See CONF-720224-.

29185 NUCLEAR REACTION THEORY. Schmid, E. (Univ., Tuebingen, Ger.). Acta Phys. Austr., Suppl.; No. 9, 44-56(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972). See CONF-720224-.

It is pointed out there are flaws in the principle $\langle\delta\phi|H-E|\phi\rangle = 0$ in nuclear reaction theory. Another principle is introduced which seems more appropriate for certain applications. Spurious states are discussed. (JFP)

29186 DETERMINATION OF VERTEX COUPLINGS FROM ANALYSIS OF SINGLE NUCLEON TRANSFER FOR REACTIONS ON ^{26}Mg, ^{27}Al, AND ^{28}Si NUCLEI. Turovtsev, V. V.; Yarmukhamedov, R. (Moscow State Univ.). Yadern. Fiz.; 17: No. 1, 62-66(Jan 1973). (In Russian).

Differential cross sections for (n,d), (p,d), (d,t), (d,^{3}He) and (^{3}He,α) reactions on ^{26}Mg, ^{27}Al and ^{28}Si nuclei are analyzed in the framework of peripheral model. (auth)

29187 ANGULAR CORRELATIONS OF FINAL PARTICLES WITH γ QUANTA IN DIRECT NUCLEAR REACTIONS IN THE FORWARD HEMISPHERE OF ANGULAR DISTRIBUTIONS. Zelenskaya, N. S.; El'-Kamkhavi, A. A.; Shalabaev, D. A. (Moscow State Univ.). Yadern. Fiz.; 17: No. 1, 52-61(Jan 1973). (In Russian).

General formulas for calculations of angular correlations in direct nuclear reactions A(x,y)B for stripping and substitution mechanisms have been obtained. Concrete analysis is presented for ^{10}B(α,d)^{12}C* and ^{11}B(α,t)^{12}C* reactions with further ^{12}C* → ^{12}C + γ(E2) decay, for which the correlation between final particles with γ-quanta has experimentally been studied. The calculation results show, that the angular correlation form is similar for both mechanisms, moreover nondiagonal terms of the density matrix, which determine correlation are almost like in both cases. However, if one of the angular moments, allowed in substitution, is strictly prohibited in stripping, the correlation form may be sensitive for the mechanism. The calculations of correlations, as well as the previous calculations of angular distributions show, that in reactions with α-particles on nuclei of p-shell stripping is not realized, as for substitution mechanism, it is possible in the case of line-by-line substitution of associations. (auth)

29188 COULOMB DISPLACEMENT ENERGIES AND THE STRUCTURE OF THE LOW-LYING NEGATIVE-PARITY STATES IN 2s-1d SHELL NUCLEI. De Meijer, R. J. (Florida State Univ., Tallahassee). Nucl. Phys.; A204: No. 2, 427-432(1973).

Negative-parity states in A = 13 to 33 nuclei are described as two-component wave functions, one containing a hole in the 1p shell, the other a particle in the 1f-2p shell. The large difference in Coulomb displacement energy (CDE) for both components has been used to determine the relative intensities by fitting the experimental CDE. For the lowest-lying states these intensities are compared to experimental ones derived from spectroscopic factors for pickup reactions. Strong binding-energy effects seem to play an important role for these states. (auth)

29189 INFLUENCE OF ATOMIC EFFECTS ON NUCLEAR REACTION ENERGIES. Staub, H. H. (Univ., Zurich). pp 10-14 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The determination of nuclear reaction energies constitutes an important and powerful method for obtaining highly accurate values of the mass and hence the binding energy of a nuclear species. Attention is drawn to the interaction of the electronic neighbourhood of the interacting nuclei and particularly to the electrons bound to the particles involved in the nuclear reaction. After reviewing several workers' contributions to the subject it is concluded that the influence of the electrons simply consists in a broadening and shift of the nuclear scattering phenomena. It is intended to investigate proton scattering on other nuclei where observations of resolved fine structure caused by the electronic shell might be more favorable. (UK)

29190 MASS FORMULA FOR LOW CHARGE ATOMIC NUCLEI. Ludwig, S. (Univ., Wuerzburg, Ger.); Hilf, E. R. H.; Suessmann, G. pp 267-271 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Low-charge atomic nuclei or extreme neutron-rich nuclei means nuclei far below the valley of β-stability in vacuum, where the number of neutrons is relatively large with respect to the number of protons. Existing mass formulae assume that the asymmetry $I = (N-Z)/A$ of the nucleus is small with respect to one, and thus extrapolating results for binding energies into the low-charge-nuclei range cannot be expected to be correct. The droplet model, supported by investigations of Thomas-Fermi systems, gives good results for nuclei along the β-valley; but in order to find a model which can be reliably extrapolated, the calculations are re-examined without the assumption $I \ll 1$. The Thomas-Fermi method itself concerning the description of density inhomogeneities is improved. (UK)

29191 IS THERE A RELATION BETWEEN THE NUCLEAR BINDING ENERGY AND THE PARAMETERS OF THE VARIABLE MOMENT OF THE INERTIA MODEL? Scharff-Goldhaber, G. (Brookhaven National Lab., Upton, NY). p 272 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

Successful models have been obtained by comparing the atomic nucleus with 1) the atom (shell model (1947)), (2) the molecule (liquid drop) (collective models of strongly deformed nuclei (1951/2) and of "vibrational nuclei" (1955)), and (3) superconductivity (pairing plus quadrupole model (1958)). (4) A phase transition between closed shell nuclei and even-even nuclei containing one or several pairs of nucleons was found. The latter are governed by the equation $\delta^3 - \delta_0\delta^2 = J(J+1)/2C$, where δ denotes the moment of inertia, J the angular momentum and δ_0 and C are parameters characteristic for a nucleus (N,Z). δ_0 is found to be highest at the centers of both neutron and proton shells, where $\delta_0 \sim A^{\frac{1}{3}}$. When the closed shell is exceeded only ~4 nucleons, δ_0 becomes negative and then gives a measure of the rigidity of the nucleus. The "stiffness parameter" C is highest for stable nuclei of each element. C decreases toward zero with increasing Coulomb (or symmetry) energy. It appears to be smaller in regions where the "gap" is relatively small. It is tempting to compare δ with the density, ρ, J with the pres-

sure, p, and the number of nucleons exceeding a closed shell (measured by δ_0) with the temperature, T, of a real gas (Van der Waals equation). The region near the phase boundary appears to be characterized by large fluctuations of δ and δ_0 at constant J. Since the shell model received an important confirmation from the appreciably higher binding energies of closed shell nuclei, the next challenge is to relate δ_0 and C to binding energies. (auth)

29192 THEORY OF DIFFRACTION SCATTERING. Sitenko, A. G.; Dotsenko, I. S. (Inst. of Theoretical Physics, Kiev). Yadern. Fiz.; 17: No. 1, 67-74(Jan 1973). (In Russian)

In order to describe the scattering of high energy particles on nucleus the diffraction or momentum approximations with account of distortion are used usually. In this work these approximations are compared. It is shown that the effects of multiple scattering are correctly taken into account only in the diffraction approximation. The differential elastic scattering cross sections of protons on the nucleus of ^{12}C at the energy 185 to 1000 MeV is calculated as an example. In the diffraction approximation the results of the calculation are in good agreement with the experimental data. (auth)

29193 SPLITTING OF THE ISOSPIN AND SPIN-ISOSPIN DIPOLE RESONANCES IN ^{12}C. Suzuki, T.; Hinohara, C. (Tohoku Univ., Sendai). Nucl. Phys.; A204: No. 2, 289-306(1973).

The splitting of the spin-isospin dipole resonance, which has been observed in the recent measurements of the cross section for electro-excitation of ^{12}C, is discussed together with the splitting of the isospin dipole resonance on the basis of the deformed nuclear model. The obtained distribution of the isospin and spin-isospin excitation strength over the giant resonance region is in good agreement with experiment. In particular, it is found that the strong spin-isospin transition should appear in the same energy region (≈23 MeV) as that of the isospin mode. This result provides a reasonable fit with the cross section for electron scattering from ^{12}C observed at backward angles with high-momentum transfer which could not be explained by previous studies. (auth)

29194 VARIATIONS OF ENERGY OF THE GROUND STATE IN THEORY OF FINITE FERMI-SYSTEMS AND NUCLEUS MASSES. Bunatyan, G. G. (Moscow Engineering-Physics Inst.). Yadern. Fiz.; 17: No. 1, 28-41(Jan 1973). (In Russian).

On the basis of the theory of finite Fermi-systems developed by Migdal, energy variations of nucleus ground state $\tilde{E}_0 - E_0$, caused by change of δn_λ of occupation numbers n_λ near the Fermi-energy when pairing correlations are taken into account are studied. With the help of the obtained formulas for Green function variations δG^s, δF the difference $\tilde{E}_0 - E_0$ is presented as expansion in variations δn_λ. The first terms of this expansion have been calculated with account for pairing correlation. Its convergence is estimated. Possible concrete applications of the obtained formulas have been considered. Calculations of the corrections for semiempirical formulas for the nucleus mass with the Strutinsky method are discussed, and the results on calculations with an approximate account for pairing of ^{208}Pb and neighboring nuclei are presented. (auth)

29195 ANNUAL REVIEW OF NUCLEAR SCIENCE. Volume 22. Segre, E.; Grover, J. R.; Noyes, H. P. (eds.). Palo Alto, CA; Annual Reviews Inc. (1972). 512p.

Separate abstracts were prepared for the 12 papers included. (JFP)

For abstracts of individual papers see: 27298, 27421, 28416, 28641, 28771, 28916, 29451, and 29196-29200.

29196 ISOSPIN IMPURITIES IN NUCLEI. Bertsch, G. F. (Michigan State Univ., East Lansing); Mekjian, A. Annu. Rev. Nucl. Sci.; 22: 25-64(1972).

After a general introduction, the theory of isospin mixing is taken up. This begins with a review of the fundamentals, and then proceeds to a discussion of the monopole state, distribution of impurity strength, and relative importance of different mechanisms. Experimental evidence for isospin impurities in isolated low-lying states is then reviewed for the cases of gamma, beta, and isospin-forbidden decays. Isospin impurities in unbound states manifest themselves as asymmetry in particle emission and spreading widths. In conclusion, the theory of isospin mixing is discussed with respect to nuclear structure and the charge dependence of the nuclear interaction. (3 figures, 8 tables, 113 references) (RWR)

29197 CALCULATION OF FISSION BARRIERS FOR HEAVY AND SUPERHEAVY NUCLEI. Nix, J. R. (Los Alamos Scientific Lab., NM). Annu. Rev. Nucl. Sci.; 22: 65-120(1972).

Self-consistent microscopic methods are considered briefly, and then attention is directed to an alternative method, the macroscopic-microscopic method. Since it is impracticable to work with a large number of coordinates, one chooses a small number that describe the most important shapes that arise; in this connection expansion in Legendre polynomials, perturbed spheroids, generalized spheroids, perturbed Cassinian ovals, two-center parametrizations, and three quadratic surfaces of revolution are discussed. Once the nuclear shape has been specified, the macroscopic energy must be calculated; this is done for the liquid-drop model, droplet model, and statistical theories. The next step is to generate single-neutron and single-proton potentials related to the nuclear shape. Potentials discussed include the modified harmonic-oscillator potential, modified two-center oscillator potentials, the infinite square-well potential, the generalized Woods-Saxon potential, the folded Yukawa potential, and spin-orbit and Coulomb potentials; the determination of potential parameters is also addressed. Once the potential appropriate to a given shape has been generated, the next step is to solve the Schroedinger equation for the single-particle energies; this can be done by expansion in harmonic-oscillator basis functions, expansion in two-center harmonic-oscillator basis functions, or finite-difference methods. After the single-particle energy levels have been found, the microscopic corrections to the potential energy must be extracted from them. The two most important of these corrections, the shell correction and the pairing correction, are discussed. For a complete theory of phenomena associated with nuclear shape changes the kinetic energy must also be known; in this connection irrotational flow, the cranking approximation, and nuclear viscosity are considered. The methods described have been applied to a variety of phenomena associated with nuclear shape changes, especially nuclear ground-state masses and deformations, fission barriers for heavy nuclei, and fission barriers and half-lives for superheavy nuclei. The same methods can be used to calculate the potential energy for heavy-ion reactions, such as in attempts to produce superheavy nuclei. (16 figures, 410 references) (RWR)

29198 ELECTROMAGNETIC TRANSITIONS AND MOMENTS IN NUCLEI. Yoshida, S.; Zamick, L. (Rutgers-The State Univ., New Brunswick, NJ). Annu. Rev. Nucl. Sci.; 22: 121-164 (1972).

Magnetic moments and M1 transitions and deviations of magnetic moments from the Schmidt values and M1 rates are discussed first. Attention is then directed to configuration mixing in second-order perturbation theory and exchange moments. The simple rotational model of deformed nuclei and the harmonic vibrational model of spherical nuclei are next briefly discussed. The following topics are then taken up: single-particle quadrupole moments and B(E2)'s; collective models, quadrupole moments, and electric transitions; effective charge theory and energies of collective states; two-particle systems; and quadrupole moments of first 2^+ states in the shell model. Anharmonic effects in quadrupole vibrations are then discussed in phenomenological and microscopic theories. Detailed comparison of the pure rotational-model prediction and experimental data shows that agreements are quite good, but not perfect, even for well-deformed nuclei; and the deviation becomes more appreciable for so-called transitional-region nuclei or higher rotational states. The rotational model can be improved by including the band mixing; and if the coupling between the rotational motion and other modes of motion is weak, then it may be treated by a perturbation approximation. As the coupling increases, more and more sophisticated theories become necessary, until the general situation to which the anharmonic vibration approach applies is reached. In this connection the following topics are discussed: perturbation approximation; variable moment of inertia (VMI) model; phenomenological theories; cranking model; generator-coordinate method; Baranger-Kumar theory; and summary on quadrupole moments of collective 2_1 states. The paper concludes with a brief discussion of E(0) transitions. (3 figures, 7 tables, 163 references) (RWR)

29199 PERTURBATION OF NUCLEAR DECAY RATES. Emery, G. T. (Indiana Univ., Bloomington, IN). Annu. Rev. Nucl. Sci.; 22: 165-202(1972).

After a historical introduction, electron capture and internal conversion are discussed as decay modes directly involving bound electrons; matrix-element and kinematic effects are included. The following nuclei studied are then examined separately in detail: ^{7}Be, ^{57}Fe, ^{89}Zr, ^{90}Nb, ^{99}Tc, ^{119}Sn, ^{125}Te, ^{169}Tm, ^{193}Pt, ^{235}U, ^{239}Pu, ^{233}U, ^{134}Cs, ^{131}I, and ^{64}Cu. Macroscopic ways of changing the rates of electron capture and internal conversion include chemical state, pressure, superconductivity, internal electric and magnetic fields, temperature, and plasmas. The last part, frankly speculative in nature, addresses itself to alpha decay, beta decay, and fission; gamma-ray emission and higher-order processes; and other possibilities. (4 figures, 2 tables, 274 references) (RWR)

29200 NUCLEAR LEVEL DENSITIES. Huizenga, J. R. (Univ. of Rochester, NY); Moretto, L. G. Annu. Rev. Nucl. Sci.; 22: 427-464(1972).

The first part of the paper deals with a theoretical outline of the methods and models employed in the evaluation of level densities. The combinatorial and partitional function methods are discussed, along with the following nuclear models: system of noninteracting fermions; the equidistant model; level densities for more complex sets of single-particle levels; level densities from the shell model; system of interacting fermions; inclusion of collective degrees of freedom. The second part discusses experimental sources of information on level densities. These include neutron resonances, charged-particle resonances, inelastic scattering and nuclear reactions to resolved levels, spectrum of evaporated particles, excitation function of isolated levels, Ericson fluctuation widths, compound-nucleus lifetime and level density from the blocking effect, excitation functions, spin distribution of the nuclear level density, and yeast levels. (12 figures, 200 references) (RWR)

29201 INCLUSION OF THE FERMI MOTION IN ELASTIC PION-NUCLEUS SCATTERING CALCULATIONS. Mach, R. (Inst. of Nuclear Physics, Rez, Czech.). Nucl. Phys.; A205: No. 1, 56-72(1973).

Taking into account the motion of target nucleons, additional terms in the Kisslinger optical-model potential are obtained. The proposed method is applicable at energies sufficiently below the $(3/2, 3/2)$ resonance. At such energies, good fits to the available data have been found for the reactions π^--^{12}C and π^--^{16}O and an improvement occurs also for the π^--^{4}He reaction. Our model gives surprisingly good results for π^--^{4}He reactions in the vicinity of the resonance at 110 and 150 MeV. (auth)

29202 SUPERALLOWED $0^+ \rightarrow 0^+$ NUCLEAR β-DECAYS. Towner, I. S.; Hardy, J. C. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nucl. Phys.; A205: No. 1, 33-55(1973).

The existing data on superallowed Fermi β-decays, including some new data on the decay of proton-rich nuclei, are analyzed incorporating detailed calculations of the statistical rate function, f, "outer" radiative corrections to order $Z^2\alpha^3$, and Coulomb corrections, δ_c. The contribution to δ_c arising from charge-dependent configuration mixing is estimated in a simple model, which relates δ_c with Coulomb displacement energies of 0^+ states in isotriplets and to off-diagonal Coulomb matrix elements. Estimates from the simple model are confirmed in more detailed shell-model computations. A second contribution to δ_c arising from binding-energy differences is calculated in a single-particle model using Saxon-Woods radial wave functions. The resulting effective coupling constant for nuclear β-decay is found to be slightly lower than the previously accepted value, and the implications in Cabibbo theory are discussed. However the scatter in experimental ft values, though reduced, is not removed by these calculations, and some discrepancies, such as were recently observed for the mass-34 mirror decays, cannot be explained. (auth)

29203 ALGEBRAIC METHOD APPLIED TO THE PAIRING INTERACTION. Dasso, C. (Univ. of Pennsylvania, Philadelphia); Klein, A.; Wang-Keiser, C. Y.; Dreiss, G. J. Nucl. Phys.; A205: No. 1, 200-210(1973).

The algebraic approach to the theory of collective motion is applied to the pairing interaction with two or three nondegenerate levels of arbitrary degeneracy each. A closed set of nonlinear algebraic equations for observables referring to the lowest-lying levels of even nuclei is derived from the relevant quasispin algebra and from the equations of motion. Number conservation and blocking can both be taken into account. The solutions agree remarkably well with exact solutions even for small systems. (auth)

29204 BRANCHING RATIO FOR RADIATIVE PION CAPTURE IN ^{6}LI AND ^{12}C. Maguire, W. (Goddard Space Flight Center, Greenbelt, MD); Werntz, C. Nucl. Phys.; A205: No. 1, 211-224 (1973).

The radiative pion capture rate in ^{12}C and ^{6}Li leading to bound final states is calculated using the impulse approximation. The T-matrix is obtained from the time-reversed pion photoproduction amplitude and initial-state distortion of the bound pion is taken into account. Using recently published capture schedules for pionic atoms the branching ratio R is calculated and compared to experimental values. The agreement is excellent if those experimental values are used that have been obtained by direct observation of the emitted γ-ray and if an optical-model value for the total 2P absorption width in ^{12}C is used. (auth)

29205 THREE-BODY TREATMENT OF BINDING EFFECTS IN MULTIPLE SCATTERING THEORY. Revai, J. (Central Research Inst. for Physics, Budapest). Nucl. Phys.; A205: No. 1, 20-26(1973).

In the description of the scattering of a particle by a system of bound particles it is usually supposed that at the moment of interaction the target particles behave as free ones (impulse approximation). We propose to take into account the deviations from this picture (binding effects), which are known to be important for low energies, by treating them as being bound by a shell-model potential. Thus we arrive at a modified multiple-scattering theory describing successive scatterings of the incident particle on different bound particles of the target. (auth)

29206 TEST OF THE RESONATING GROUP METHOD IN A THREE-PARTICLE PROBLEM. Schwager, J.; Schmid, E. W. (Univ., Tuebingen, Ger.). Nucl. Phys.; No. 1, 168-176(1973).

Elastic scattering of a boson from a bound pair of bosons is used as a numerical example to test some qualities of the resonating group method. It is shown explicitly that the method does not converge when approximations are used for the asymptotic wave function. Reasonable results can be obtained despite the fact of nonconvergence when the choice of distortion functions is restricted in a prescribed way. The same choice of distortion functions leads to very accurate results in resonating group calculations with exact channel functions. (auth)

29207 CALCULATION OF THE INDIRECT CONTRIBUTION TO THE HEAVY-ION NUCLEON TRANSFER REACTION AMPLITUDE. Tobocman, W. (Case Western Reserve Univ., Cleveland); Ryan, R.; Balitz, A. J.; Kahana, S. H. Nucl. Phys.; A205: No. 1, 193-199(1973).

The indirect contribution to the heavy-ion nucleon transfer reaction amplitude has been evaluated using the distorted-wave Born approximation neglecting recoil effects. This contribution is usually ignored. Two different formulations of the indirect interaction were tried. One of these formulations gives a completely negligible contribution to the nucleon transfer reaction amplitude. The other gives a negligible effect for the angular dependence of the differential cross section but nevertheless produces a considerable change in the magnitude of the cross section. (auth)

29208 PARITY NONCONSERVATION IN NUCLEI. Gari, M. (Ruhr-Univ., Bochum, Ger.). Contract AT(04-3)-63. Phys. Rep.; 6C: No. 5, 317-377(Feb 1973).

The present status of investigations of parity-nonconserving forces in nuclei is outlined. Basic problems concerning alpha- and gamma-decay calculations are discussed. Special attention has been paid to the treatment of short-range nucleon-nucleon correlations. (auth)

29209 COLLECTIVE CONTRIBUTION TO ESCAPE WIDTH OF ANALOG RESONANCES. Auerbach, N.; Bertsch, G. (Michigan State Univ., East Lansing). Phys. Lett.; 43B: No. 3, 175-177(5 Feb 1973).

The collective isovector monopole state decreases escape widths of analog states by 10-20%. Thus spectroscopic factors determined in previous calculations are too small by this amount. The monopole has a much greater influence on the spreading widths; the reason it is less important in the decay width is that the transition density is more external to the nucleus. (auth)

29210 LINEAR RELATIONS BETWEEN RANK-1 POLARIZATIONS IN NUCLEAR REACTIONS. Seiler, F. (Univ., Basel). Helv. Phys. Acta; 46: 56-57(1973).

The angular distributions of rank-1 polarizations for different particles in the ^{3}He(d,p)^{4}He reaction show striking similarities, which have stimulated considerable theoretical interest. Since a number of broad resonances have been found in ^{5}Li, the effect of an overlap of two dominant matrix elements was investigated. A relation is obtained for the Legendre polynomial expansion coefficients of the appropriately normalized vector polarization observables: this relation depends solely on the channel spins of the two interfering matrix elements. The results are compared with experimental data, and it is concluded that the level structure in ^{5}Li is largely responsible for the differences between the model predictions and the experimental data. (RWR)

29211 NUCLEAR OPTICAL MODEL CODE FOR SMALL COMPUTERS. Eastgate, R. J. (Univ. of North Carolina, Chapel Hill); Thompson, W. J.; Hardekopf, R. A. Comput. Phys. Commun.; 5: No. 1, 69-79(Jan 1973).

A computer program OPTICS is described, which performs nonrelativistic calculations of differential cross sections and vector and tensor polarization analyzing powers for the elastic scattering of a particle of spin s = 0, $\frac{1}{2}$, or 1 from a particle

whose spin is ignored. Scattering data are analyzed in terms of an optical model potential including spin orbit coupling (for s = $\frac{1}{2}$, 1) and an optional compound-elastic cross-section calculation. The program fits into a small computer, permitting both batch-processing and interactive data analysis. (LBS)

29212 SOME PROPERTIES OF THE CONVERSION PARAMETERS b_2 AND THE COEFFICIENTS OF INTERNAL CONVERSION IN THE UPPER ATOMIC SHELLS. Shulyakouski, G. S.; Trusau, V. F. (Belorussian State Univ., Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 1, 117-123(1973). (In Belorussian).

Numerical values for the parameters b_2(ML), b_2(EL), and b_2(MLE2) were obtained at the N_I, $N_{II} \cdot O_I$-subshells of an atom in regular correlation functions for internal conversion. Dynamic structural corrections in magnetic coefficients of internal conversion, approximate estimates of relative coefficients of internal conversion, and shielding parameters were investigated. (tr-auth)

29213 POSSIBILITY OF SECOND-CLASS CURRENTS IN GAMOW-TELLER β-DECAY. Wilkinson, D. H. (Univ. of Washington, Seattle). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 307-326 (1972).

Mirror Gamow-Teller β-decay takes place from members of isospin multiplets to a common final state or to final states that are mirrors of each other. It is found that in these cases the intrinsic speed of the positon emission is systematically lower, by 10 to 15 per cent, than that of the mirror negaton emission. This difference could be due to a fundamental weak interaction effect, a second-class term in the weak hadronic current, or to a failure of exact symmetry in the nuclear structure. The influence of binding energy differences is studied in the latter context, and it is concluded that they cannot be responsible for the empirical asymmetry. The effects of changes of configurational mix across the multiplets are also considered; very few estimates have been explicitly made, but it would be surprising if this effect turned out to be of constant sign and magnitude over the wide range of A involved. No present firm conclusion can be made, but none of the empirical evidence is inconsistent with the reality of a largely momentum-transfer-independent second-class current. (auth)

29214 ALPHA-PARTICLE SPECTROSCOPIC AMPLITUDES AND THE SU(3) MODEL. Ichimura, M. (State Univ. of New York, Stony Brook); Arima, A.; Halbert, E. C.; Terasawa, T. Contract AT(11-1)-3001. Nucl. Phys.; A204: No. 2, 225-278 (1973).

Formulas for calculating spectroscopic amplitudes for emission or transfer of α particles are developed in the framework of the harmonic-oscillator shell model with SU(3) classification. These formulas are applied to some interesting states of ^{20}Ne, e.g., low-lying $(sd)^4$ shell-model states, members of the lowest $K = 0^-$ band with SU(3) label (90), and $2\hbar\omega$ excited states with SU(3) label (10,0). Spurious cm motion is removed. The formulas are also applied to the ground and some excited states of ^{16}O. The ^{16}O wave functions of Brown and Green are used in an investigation of how the mixing among 0p-0h, 2p-2h, and 4p-4h states affects the wave function for relative motion between the α cluster and the mass-12 nucleus. These calculations indicate much larger α reduced widths for states which are mainly 4p-4h than for states which are mainly 0p-0h or 2p-2h. Spectroscopic amplitudes are also calculated for some ^{16}O and ^{12}C states described as linear chains of α particles. (auth)

29215 COMMENTS ON TERNARY FISSION: POST-SCISSION α-PARTICLE EMISSION. Vass, D. G. (Univ. of Edinburgh). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 295-306(1972).

The possibility of α-particle emission from fully accelerated fission fragments is considered. The results of trajectory calculations for such α-particles emitted during the fission of ^{252}Cf are presented, and their significance in relation to the observed energy and angular distributions of the α-particles is discussed. (auth)

29216 EFFECT OF FRAGMENT ANISOTROPY ON PROMPT NEUTRON ENERGY AND ANGULAR DISTRIBUTIONS. Ajitanand, N. N.; Kapoor, S. S. (Bhabha Atomic Research Centre, Trombay, India). pp 37-43 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1973).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol. 14B).

29217 "R" MATRIX AND SELF NUCLEAR REACTIONS. Swarup, R. (D. S. Coll., Aligarh, India). pp 61-65 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29218 A-DEPENDENCE OF THE OPTICAL MODEL POTENTIAL. Agrawal, D. C.; Sood, P. C. (Banaras Hindu Univ., India). pp 73-80 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29219 CALCULATION OF THE REAL PART OF THE OPTICAL-MODEL POTENTIAL. Usmani, Q. N.; Ahmad, I. (Aligarh Muslim Univ., India). pp 81-86 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay. February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29220 COMPLEX ANGULAR MOMENTUM METHODS FOR COMPOSITE PARTICLE-NUCLEUS ELASTIC SCATTERING. Satpathy, R. K. (Univ. of Sambalpur, India); Mishra, D. K.; Samaddar, S. K. pp 87-92 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29221 EXACT DESCRIPTION OF (d,p) REACTION. Samaddar, S. K.; Mukherjee, S. (Saha Inst. of Nuclear Physics, Calcutta). pp 107-109 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29222 CALCULATION OF ISOSPIN CENTROID ENERGIES OF STATES EXCITED VIA STRIPPING REACTIONS. Shelly, S.; Bansal, R. K. (Panjab Univ., Chandigarh, India). pp 111-116 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29223 EQUIVALENCE OF TWO INTERNUCLEON POTENTIALS IN THE σ_{Int} CALCULATIONS. Srivastava, B. K.; Raghavan, S. S. (Indian Inst. of Tech., Kharagpur). pp 133-136 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29224 ALLOWED RANGE OF PION-NUCLEON COUPLING CONSTANT USING OBE TYPE AND HAMADA-JOHNSTON TYPE POTENTIALS. Zahid, M. (Aligarh Muslim Univ., India). pp 179-182 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29225 NUCLEAR LEVEL DENSITY AND THE SUPERMULTIPLET MODEL. Ramamurty, S.; Ramanathan, A.; Murty, G. S. N.; Ramana Murty, M. V. (Andhra Univ., Waltair, India). pp 207-209 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29226 SEPARABLE POTENTIAL MODEL FOR $^1S_0$ NEUTRON-PROTON INTERACTION. Sirohi, A. P. S.; Srivastava, M. K. (Univ. of Roorkee, India). pp 211-215 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29227 UNITARY POLE EXPANSION OF THE T-MATRIX ELEMENTS FOR LOCAL POTENTIALS WITH HARD-CORE. Mathur, V. S.; Lagu, A. V.; Maheshwari, C. (Banaras Hindu Univ., India). pp 217-221 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29228 EXCITATION SPECTRUM FOR NUCLEAR MATTER. Khanna, K. M. (Univ. of Dibrugarh, India); Sharma, M. I. pp 227-232 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29229 DEPENDENCE OF THE SENSITIVITY OF NUCLEAR MATTER BINDING ENERGY TO THE HIGH-ENERGY PHASE SHIFTS ON THE RANGE OF FORCE. Srivastava, M. K. (Univ. of Roorkee, India). pp 233-237 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29230 PHENOMENOLOGICAL MODELS OF ROTATIONAL SPECTRA AND CLASSIFICATION OF NUCLEAR SHAPES. Mantri, A. N.; Sood, P. C. (Banaras Hindu Univ., India). pp 239-245 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29231 TRUNCATION OF CONFIGURATION SPACE AND THE NATURE OF EFFECTIVE TWO-BODY INTERACTION. Gupta, R. K. (Panjab Univ., Chandigarh, India); Pandya, S. P. pp 267-271 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29232 VARIATION AFTER PROJECTION AND PROJECTED HARTREE METHOD: A COMPARISON IN A SCHEMATIC MODEL. Sharma, S. K.; Bhatt, K. H. (Physical Research Lab., Ahmedabad, India). pp 283-286 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29233 EFFECT OF CONSTANCY OF BASIS ON TRANSITION PROBABILITIES IN ODD-ODD NUCLEI. Sharma, S. D. (Panjabi Univ., Patiala, India). pp 287-290 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29234 MULTICHANNEL FADDEEV EQUATIONS AND THE BOUND STATES OF (npα) AND (nαα) SYSTEMS. Chuu, D. S. Buffalo; State Univ. of New York (1972). 133p. University Microfilms Order No. 73-5091.

Thesis (Ph. D.).

The lowest bound state energies of the nuclei ^{6}Li and ^{9}Be are calculated on the multichannel three-body model using the Faddeev equations. In order to take into account the fact that the α-particle is not an elementary particle, we have generalized the Faddeev equations for a three-body system that may involve particles with internal states and spins. To keep the mathematical complication caused by introducing the particle internal structure to a minimum, we have assumed that the α-particle has only two internal states. All the two-body interactions involved in these calculations are phenomenological local potentials that fit the low energy two-body scattering data. The α-α potential in this model is a 3 × 3 matrix while the N-α potential is a 2 × 2 matrix. Both of them have l-dependence where l denotes the order of partial waves. Han has obtained two sets of parameters for the α-α potential that fit the low energy two-body scattering equally well in his study of ^{12}C. The N-α potential is obtained in the present work. Again there are two sets of parameters that can fit the data more or less to the same extent. For the nucleon-nucleon interaction we take the Pease-Feshbach potential that has been shown to give satisfactory results in three-body calculations. With these potentials, the multichannel Faddeev equations are solved in a separable T-matrix approximation which has been shown to converge quickly. The couple integral equations are then reduced to a set of equations with one variable. Finally the bound state energies are obtained by solving the determinant for zeros. We have calculated the energies for the lowest 1^{+} and 0^{+} states in the case of ^{6}Li for both the N-α potentials. We find the energies calculated from one set of potentials in excellent agreement with experiment while the other set of potential yields a ground state energy about 25% too small. The energy splitting between these two states, however, agrees quite well with experiment for both the potentials. In the calculation of ^{9}Be we use the α-α and N-α potentials that give better agreements in the cases of ^{6}Li and ^{12}C to calculate the energies of $3/2^{-}$ and $1/2^{+}$ states. It is found that the calculated ground state energy is only about 10% too large and the energy splitting between these two states is 2.44 MeV compared to the experimental value 1.75 MeV. When compared with the previous calculations we find that our results are consistently better in each of these cases. The internal structure effect of the three-body binding energies has also been studied within our framework with about 6% and about 15% for (npα) and (nαα) systems respectively. (Diss. Abstr. Int., B)

29235 CONTRIBUTIONS OF TIME-REVERSAL NONINVARIANT TERMS IN ELECTRON-NUCLEUS ELASTIC SCATTERING. Krase, L. D. Ames, IA; Iowa State Univ. (1972). 81p. University Microfilms Order No. 73-3902.

Thesis (Ph. D.).

The possibility of using elastic scattering of electrons from nuclei having spin one or greater to search for T-noninvariant effects in electromagnetic processes was investigated. In the one-photon-exchange approximation of the elastic scattering process, terms which are invariant under P and PCT but noninvariant under T may be explicitly included in the nuclear current for the interaction of these nuclei. The transformation properties of the various terms which may contribute to the current were developed and discussed within a manifestly covariant framework. The current was then specialized to a noncovariant form in the Breit (or brick-wall) frame of the nucleus. This noncovariant form was then used to determine tests which could be used to search for T noninvariant effects. Two restrictions were placed on the types of experimental tests which could be made: the polarization tensors were taken to be, at most, second rank; the measurable quantities were taken to be the cross sections and the electron beam polarizations. If the nuclear target is completely described by a vector polarization only, with a component normal to the scattering plane, the cross section for the scattering of unpolarized electrons has an asymmetry if the electromagnetic interaction is noninvariant under T. If the nuclear target is completely described by a second rank tensor only, with components in the scattering plane, an initially unpolarized electron beam has a polarization after the scattering if the electromagnetic interaction is noninvariant under T. These tests, however, are not completely unambiguous. The polarization tensors of other rank may give a contribution which is not zero even when the electromagnetic interaction is invariant under T. In addition, the higher-order processes may give a non-zero contribution even when the interaction is T invariant, as is demonstrated for the test involving the asymmetry in the cross section. (Diss. Abstr. Int., B)

29236 EXPERIMENTS IN NUCLEAR PHYSICS AND THEIR INTERPRETATION. Part 1. Bodenstedt, E. Mannheim, Ger.; Wissenschaftsverlag (1972). 290p. (In German).

In this book an attempt is made to present a selection of basic experiments in nuclear physics and to show how the present picture of the atomic nucleus and its effective forces influence these experiments. In the first of the three volumes in this issue, experiments are treated according to their different types of interaction, natural radioactivity, atomic nuclei systematics as well as strong interactions. (100 figures) (GF)

29237 EFFECT OF EXCHANGE CURRENTS ON ORBITAL g-FACTORS AND E1 SUM RULE FOR PHOTOABSORPTION. Arima, A.; Brown, G. E.; Hyuga, H.; Ichimura, M. (State Univ. of New York, Stony Brook). Contract AT(11-1)-3001. Nucl. Phys.; A205: No. 1, 27-32(1973).

The relation between the enhancement, κ, in the E1 sum rule and the enhancement, δg_1, of the orbital magnetic moment is reinvestigated. The relation $\kappa = 2\delta g_1$ of Fujita and Hirata is modified to $\kappa' = 2\delta g_1$, where κ' is the enhancement following from $V_{\sigma\pi}$. The tensor correlation leads to large $\Delta\kappa = \kappa - \kappa'$ as well as κ and κ'. (auth)

29238 BROKEN Sp (3,3) SYMMETRY AND THE SPECTRA OF DEFORMED EVEN-EVEN NUCLEI. Raichev, P. P. (Univ., Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 11, 1503-1505 (1972).

The hypothesis is formulated that the positive parity states of the deformed even-even nuclei form (λ,μ) multiplets of SU(3) with high values of λ and small values of $\mu(\lambda,\mu,\text{even})$. The possible causes of the origin of the SU(3) multiplets are discussed. (JFP)

29239 SUPERMULTIPLET EXPANSION AND EFFECTIVE INTERACTIONS IN THE NUCLEAR P-SHELL. John, G.; Kramer, P. (Univ., Tuebingen, Ger.). Nucl. Phys.; A204: No. 1, 203-208 (1973).

Nuclear levels in the p-shell are analyzed with respect to supermultiplet quantum numbers. It is shown that effective interactions favor the lowest supermultiplets in both ground and excited states. (auth)

29240 ISOVECTOR MONOPOLE VIBRATION: COULOMB ENERGIES, BREAKING OF CHARGE SYMMETRY, AND EFFECTS FROM α-PARTICLE CORRELATION IN THE NUCLEAR SURFACE. Brown, G. E. (State Univ. of New York, Stony Brook); Horsfjord, V.; Liu, K. F. Contract AT(11-1)-3001. Nucl. Phys.; A205: No. 1, 73-80(1973).

Correlations involving four particles, which can be visualized as itinerant α particles, can occur with some probability (which is hard to estimate) in the nuclear surface, as has been discussed innumerable times. It is pointed out that such clustering would lead to a small four-body effective force, which could have important effects in the Coulomb energy difference of mirror nuclei and in the isovector isotope shift. This four-body force is viewed as a force additional to that coming out of Brueckner–Bethe type G-matrix calculations. If one used it literally, which use is probably not justified, one would get into serious trouble with the two-body spectra, such as the spectrum of ^{42}Ca. If one uses it circumspectly, one still gets into some trouble, but the trouble does not seem to be serious. (3 figures) (auth)

29241 SEPARABLE TERMS OF THE EFFECTIVE INTERACTION IN THE TWO-PARTICLE CHANNEL FOR $J \neq 0$ PAIR VIBRATIONS. Landi, G.; Matera, F. (Univ., Florence). Lett. Nuovo Cim.; 6: No. 11, 397-400(17 Mar 1973).

Both $J = 0$ and $J \neq 0$ levels are observed in two-nucleon-transfer reactions. In the theory of finite Fermi systems it is possible to define an effective scattering amplitude corresponding to a renormalized interaction between quasi particles. It is possible to express this amplitude in terms of the universal amplitude for the scattering of quasi particles in infinite nuclear matter. Consideration is limited to the universal part, and the functional form of the universal amplitude in the coordinate representation is determined as a Fourier transform of the amplitude in nuclear matter. The properties of the levels that can be obtained are also found. The treatment is restricted to low values of l. (RWR)

29242 SELF-SCREENING OF THE PARTICLE-HOLE INTERACTION AND THE EFFECTIVE CHARGE. Kuo, T. S. S. (State Univ. of New York, Stony Brook); Osnes, E. Contract AT(11-1)-3001. Nucl. Phys.; A205: No. 1, 1-19(1973).

The diagrams of the Tamm–Dancoff and random-phase approximations were summed to calculate the effective charge in the 1s0d and 1p0f shells. The generally large RPA result for the effective charge is reduced to roughly the TDA one when the self-screening corrections to the particle–hole and ground-state correlation vertices are included. The screening corrections serve to suppress the collectivity of the isoscalar quadrupole core phonons and are particularly important for ^{40}Ca, where the isoscalar quadrupole mode is near collapse in the RPA using the bare particle-hole interaction. The qualitative rather than the quantitative effects of these and other corrections are stressed. (auth) (5 figures, 7 tables)

29243 NUCLEAR ROTATION AT HIGH ANGULAR VELOCITIES. Johnson, A. (Univ. of Copenhagen); Szymanski, Z. Phys. Rep.; 7C: No. 4, 181-222(Mar 1973).

Deformed nuclei rotating with very high angular velocities reveal many interesting properties of the strongly interacting quantal many-body system. Highly excited collective states are preferentially populated in heavy-ion reactions. In many nuclides a gradual increase of the moment of inertia with the angular velocity has been established; however, in some deformed nuclides a drastic behavior of the moment of inertia at spin-values around 12 to 16 $\hbar$ has been experimentally well confirmed. This review aims not only to present the experimental results but also to discuss representative theoretical approaches to explain the observed behavior. (auth) (25 figures, 1 table, 134 references)

29244 EFFECT OF THE TENSOR FORCE ON THE ^{4}He GROUND STATE. I. Guiasu, I.; Scutaru, H. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 17: No. 7, 783-794 (1972).

The tensor force formalism for $A = 4$ is described in a truncated basis of completely antisymmetric functions, and for a Gaussian form of the radial dependence of the nucleon–nucleon realistic potential. The analytical results without short-range correlations and the way in which they can be extended to the case of Jastrow type correlations taken into account are presented. (auth)

29245 GENERALIZED TALMI–MOSHINSKY PROCEDURE FOR THE TWO-BODY MATRIX ELEMENTS INCLUDING UNBOUND STATES. Sandulescu, A. (Inst. for Atomic Physics, Bucharest); Tarnoveanu, I. G. Rev. Roum. Phys.; 17: No. 7, 777-781(1972).

The Talmi–Moshinsky procedure for computing the two-body matrix elements was generalized to the case of matrix elements including unbound states. Explicit expressions of the generalized two-body matrix elements were obtained based on the expansion of the radial part of the unbound state in a product of a Gauss function and an expansion in radial harmonic oscillator wave functions. (auth)

29246 NUCLEAR MATTER CALCULATIONS. II. INSERTIONS IN HOLE AND PARTICLE LINES. Koehler, H. S. (Univ. of Arizona, Tucson). Nucl. Phys. A204: No. 1, 65-80(1973).

Brueckner–Goldstone diagrams that represent insertions in the particle and hole lines of the basic two-body ladder diagram are claculated with the Reid soft-core potential. The bubble insertions in particle lines are calculated exactly, off the energy shell, for small excitations ($\leq 2k_F$), and contribute 1.5 MeV to the binding energy of nuclear matter. Comparisons are made with the approximations used by Brueckner and Gammel (BG) and by Bethe, Brandow and Petschek (BBP). The BG method is found to be fairly accurate for the treatment of small excitations. The BBP method, used in Dahiblom's three-body work, underestimates the binding by 0.7 MeV. The third-order insertion in hole lines contributes 1.8 MeV to the binding energy, when the reaction matrix is calculated with the bubble insertions in particle lines. Without these bubble insertions the contribution is 1.0 MeV. The difference is due to the slower healing when bubble insertions in particle lines are included as the gap between hole and particle energies then decreases. Inclusion of other higher-order diagrams reduces the contribution from the third-order insertion from 1.8 to 1.2 MeV. Day estimated this contribution to be 0.6 MeV. Bethe, using Dahiblom's and Day's results concludes that the Reid soft core gives 15.4 MeV binding. Our calculations suggest that this could be increased to 16.7 to 17.3 MeV. (auth)

29247 SIMPLIFIED APPROACH TO THREE-BODY CORRELATIONS IN NUCLEAR MATTER THROUGH A NON-ZERO PARTICLE SPECTRUM. Grange, P.; Preston, M. A. (McMaster Univ., Hamilton, Ont.). Nucl. Phys.; A204: No. 1, 1-25 (1973).

Self-consistent nuclear-matter calculations are presented which take into account Dahiblom's results for the contribution to the binding energy due to three-body correlations. We propose a justified parametrization of the single-particle potential for particle states, the energy contribution of which cancels approximately the energy from certain three-body correlations. Indications are given of how to fix this particle-state potential for a given two-body interation. Two nucleon–nucleon potentials are used: the Reid soft-core potential and a fully momentum-dependent one-boson-exchange potential similar to the form proposed by Ingber and Potenza. The mechanism of the increase in the total wound due to three-body correlations is investigated, and reasons are given why this does not prevent the saturation densities from moving to higher values. Due to three-body correlations and with self-consistency on the hole spectrum, the increase in nuclear-matter binding energy is 0.60 MeV/A for the OBEP. The saturation momentum is shifted from 1.42 fm^{-1} for the Reid potential and from 1.58 fm^{-1} to 1.62 fm^{-1} for the OBEP. (auth)

29248 DEPENDENCE OF THE SENSITIVITY OF NUCLEAR-MATTER BINDING ENERGY TO THE HIGH-ENERGY PHASE SHIFTS ON THE RANGE OF FORCE. Srivastava, M. K. (Univ. of Roorkee, India). Indian J. Pure Appl. Phys.; 10: No. 8, 583-584(Aug 1972).

Second rank separable potentials are used to investigate the dependence of the binding energy per particle in nuclear matter on the phase shifts beyond $k = 2$ fm^{-1}. It is found that the results are rather insensitive to the variations of the high energy phase shifts except when the attractive form factor of the separable potential is unrealistically short-ranged. (auth)

29249 DEVELOPMENT TRENDS IN NUCLEAR PHYSICS. Bethge, K. (Univ., Heidelberg). Umschau; 71: No. 18, 657-662 (1972). (In German).

The article begins by describing the fundamental problem of nuclear physics, the nature of the nuclear force. This topic leads to a discussion of collective nuclear models and experimental methods for studying nuclei. The bulk of the article concerns nuclear reactions: α-transfer reactions (including α-pickup reactions) and cluster transfer in heavy-ion reactions are examined. Then elastic scattering is briefly considered. Finally, super-

heavy nuclei are treated, including the possible discovery of element 112 in the W beam stop of the CERN proton synchrotron. (8 figures) (RWR)

29250 SEPARABLE-POTENTIAL MODEL FOR THE NUCLEON–NUCLEUS INTERACTION. Stancu, F. (Univ., Liege). Nucl. Phys.; A205: No. 3, 561-573(1973).

On the basis of qualitative microscopical arguments we present a single-particle potential of finite rank which provides a complete unperturbed basis for the shell-model approach to nuclear reactions. The bound-state wave functions are orthogonal to the continuum ones and are approximated by harmonic-oscillator wave functions. The scattering states depend on both the bound-state wave functions and the form factor of a potential term acting only in the continuum space. A convenient choice for the form factor allows us to derive analytic expressions for the phase shift. The model is successfully applied to the elastic scattering of neutrons from ^{16}O below 5 MeV. (auth)

29251 MONTE CARLO CALCULATIONS OF TWO-NEUTRON TRANSFER CROSS SECTIONS. Bayman, B. F.; Feng, D. H. (Univ. of Minnesota, Minneapolis). Nucl. Phys.; A205: No. 3, 513-530(1973).

Differential cross sections for (t,p) and (p,t) reactions have been calculated in finite-range distorted-wave Born approximation, with the Monte Carlo method used to evaluate the six-dimensional integrals. The use of the Monte Carlo method makes it possible to treat cases of nonzero angular momentum transfer. Angular distributions and relative cross sections are in good agreement with those given by the zero-range approximation. The cross sections of unnatural-parity transitions, as calculated by our one-step finite-range DWBA, are several orders of magnitude smaller than experimental data, suggesting the importance in these reactions of two-step processes. (auth)

29252 ELASTIC SCATTERING AND CHARGE EXCHANGE OF 156 MEV PROTONS FROM TRINUCLEONS. Narboni, P. (Paris Univ., Orsay, France). Nucl. Phys.; A205: No. 3, 481-487(1973).

Multiple scattering effects have been investigated in $^3H(p,p)^3H$, $^3He(p,p)^3He$ and $^3H(p,n)^3He$ reactions at 156 MeV using the Glauber approximation, and taking into account spin dependence in the nucleon–nucleon amplitudes. Good agreement with experimental data is obtained for differential cross sections in the forward direction. Several wave function effects are discussed (short-range correlations, S′ and D states). (auth)

29253 DEUTERON BREAK-UP IN THE FIELD OF THE NUCLEUS. Lang, J.; Jarczyk, L.; Mueller, R. (Laboratorium fuer Kernphysik, Zurich). Nucl. Phys.; A204: No. 1, 97-109 (1973).

The break-up of deuterons in Coulomb and nuclear fields is calculated in the framework of a distorted-wave Born approximation (DWBA). The matrix element in the post-interaction formulation is evaluated using a partial-wave decomposition. The results are in very good agreement with recent experiments, but only if nuclear forces are included. In addition, other theoretical models for the disintegration of deuterons are reviewed critically. (auth)

29254 PHASE-SHIFT ANALYSIS OF $^{16}O + ^{16}O$ ELASTIC SCATTERING. Volt, H.; Helb, H. D. (Univ., Erlangen, Ger.). Nucl. Phys.; A204: No. 1, 196-202(1973).

A phase-shift analysis has been carried out for $^{16}O + ^{16}O$ elastic scattering, resulting in unambiguous values for the reflection coefficients in the energy range of the first gross structure of the 90° excitation function, and answering some of the questions still open regarding the calculations existing so far. (auth)

29255 THEORY OF ELASTIC SCATTERING OF HEAVY IONS WITH IDENTICAL CORES. Bauer, G.; Gelbke, C. K. (Max Planck-Institut fuer Kernphysik, Heidelberg). Nucl. Phys.; A204: No. 1, 138-148(1973).

Starting from a two-potential formula for the elastic scattering T-matrix of two heavy ions with identical cores, a DWBA treatment is obtained. This approach is compared with the LCNO theory; differences and similarities are discussed. An analysis of the $^{12}C + ^{13}C$ and $^{28}Si + ^{28}Si$ elastic scattering is given and shows good agreement with the data. (auth)

29256 TWO-STEP PROCESSES IN THE (d,p) REACTION ON RARE EARTH NUCLEI. Jaskola, M. (Inst. of Nuclear Research, Warsaw); Kozlowski, M. Acta Phys. Pol.; B4: No. 1, 145-150 (1973).

The two-step model of the (d,p) reaction is investigated. The inclusion of nonelastic scattering in the entrance and exit channels improves the agreement between the calculated values and experimental data, but the discrepancies in the absolute strengths remain. (auth)

29257 APPROXIMATE TREATMENT OF COLLISION INTEGRALS FOR INELASTIC SCATTERING AND (n,2n) REACTION BY SYNTHETIC KERNEL APPROXIMATION. Yamamura, Y. (Okayama Coll. of Science, Shuku, Japan); Yamamoto, K.; Sekiya, T. J. Nucl. Energy; 27: No. 3, 151-169(Mar 1973).

An approximate treatment of the collision integrals for inelastic scattering and (n,2n) reaction is studied in order to take the energy distribution of neutrons emitted in these reactions into the slowing down calculations. The (n,2n) reaction is treated by cluster model. An approximate synthetic kernel for inelastic scattering is proposed in order to calculate the inelastic collision integral by a simple recursion relation, which allows its rapid computation. The application of the present approximate method to calculations of fast neutron spectra and the fast effects proved that the present synthetic kernel was very useful for treatment of inelastic scattering and (n,2n) reaction. (auth)

29258 NUCLEAR REACTIONS AND REACTION MECHANISM. I. Nalda, J. C. (Instituto de Investigaciones y Aplicaciones Tecnicas Nucleares, Valladolid, Spain). Energ. Nucl. (Madrid); 16: No. 79, 563-573(1972). (In Spanish)

A general report is made on the origins and the importance of the study of nuclear reactions and the reaction mechanisms. The experimental techniques used are discussed. A more detailed report is made of the reaction mechanisms, including problems associated with the compound nucleus which is treated with a rigorous mathematical formalism, diverse theories which permit the evaluation of the elements of the matrix, the theory of the matrix R_w, and use of the projection operators. (tr-auth)

29259 YADERNYE REAKTSII PRI VYSCKIKH ENERGIYAKH. (Nuclear Reactions at High Energies). Denisov, F. P.; Mekhedov, V. N. Moscow; Atomizdat (1972). 232p.

The results of theoretical and experimental investigations of high-energy nuclear reactions completed during the last two decades are presented. The direct interaction model in its quantum mechanical and classical variants is discussed in detail. Intranuclear cascades, decay of excited nuclei, the study of fission reactions using photoemulsions or counters and magnetic analysis; and radiochemical investigations are the main topics of this monograph. (447 references, 73 figures, 43 tables.) (KSW)

29260 CORRELATION EFFECTS FOR ELECTRONS OF INNER CONVERSION FOLLOWING NUCLEI β-DECAY. Lyul'ka, V. A. (Inst. of Atomic Energy, Moscow). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 1, 37-43(Jan 1973). (In Russian).

Correlation effects are considered for transitions of inner conversion accompanying the β-decay of nuclei of the first and second order prohibition. Coefficients are deduced depending on nuclear matrix elements and electron functions and determining correlation effects for the nucleus cascade decays following β-decay of an arbitrary order of prohibition. By means of these coefficients formulas are obtained for angular and polarization correlations of β-electrons and conversion electrons. A formula is also presented to correlate polarizations of electrons. Correlation effects in case of unique nuclear transitions are discussed in detail. (auth)

29261 OPTICAL POTENTIAL FOR NUCLEI WITH COLLECTIVE STATES. Kujawski, E. (Massachusetts Inst. of Tech., Cambridge). Lett. Nuovo Cim.; 6: No. 8, 277-282(24 Feb 1973)

For nuclei which possess strongly excited low-lying states, the corrections to the first-order optical potential arising from the virtual excitation of these collective states may be important; and unless they are explicitly included in a coupled-channels calculation, the parameters of the resulting optical potential are no longer simply related to the target density and appear to be anomalous. The contributions from these collective states are reflected as differences in the optical potentials employed in coupled-channels and DWBA calculations. The determination of a local optical potential that reproduce the elastic part of a given multichannel scattering problem is quite complicated, and the solution is nonunique. A simple construction of a local optical potential is presented which uses the high-energy eikonal approximation as an intermediary. The development is carried out for the generalized optical potential for vibrational nuclei. The resulting optical potential may then be inserted into the Schroedinger equation and solved exactly, this procedure removing the limitations of the high-energy eikonal approximation, which is not

reliable at medium energies and nonforward angles. The approach is illustrated for the scattering of 64.3-MeV α particles by ^{58}Ni. The real and imaginary parts of the optical potential and the elastic differential cross section are shown. (2 figures) (RWR)

29262 FAST NEUTRON POLARISATION. Galloway, R. B. (Univ. of Edinburgh). Proc. Roy. Soc. Edinburgh, Sect. A; 70: 181-190(1972).

The state of knowledge of fast neutron polarisation due to elastic scattering is reviewed in relation to the optical model of the process. There is clearly a substantial leak of polarisation data at neutron energies and concerning nuclei appropriate to the optical model description. The situation for the extremes of small and of large angle scattering is also considered. (auth)

29263 NUCLEAR INERTIAL MASS PARAMETER FOR DIFFERENT FORMS OF THE QUADRUPOLE FORCES. Stepien-Rudzka, W. (Inst. of Nuclear Research, Warsaw). Acta Phys. Pol.; B4: No. 1, 65-73(1973).

The inertial mass parameter B for collective oscillations of the quadrupole types is calculated. The quadrupole forces are taken in the form $Q = F(r)Y_{20}(\Omega)$, where F(r) assumes three different functional forms. Numerical calculations are performed in the rare-earth region. (auth)

29264 MAGNETIC MOMENT AND DEFORMED COMPONENT IN ^{41}Ca AND ^{39}K. Erikson, T. (NORDITA, Copenhagen). Nucl. Phys.; A205: No. 3, 593-613(1973).

It is found that the inclusion of deformed core-excited states in the wave functions for ^{41}Ca and ^{39}K produces important corrections to the magnetic moments. The discrepancies between observed magnetic moments and theoretical predictions are considerably reduced in both cases. The deformed components also account for a large part of the experimentally found reduction of the Gamow–Teller matrix element in β-decay. It is pointed out that the fact that high spatial symmetry seems to be favored in the ^{16}O region may provide an explanation of the small reduction of the Schmidt value in ^{17}O. (auth)

29265 COLLECTIVE CORRELATIONS FOR CONTINUUM STATES OF ^{12}C IN THE REGION OF THE GIANT DIPOLE RESONANCE. Mshelia, E. D. (Univ., Frankfurt am Main); Barrett, R. F. Nucl. Phys.; A205: No. 3, 581-592(1973).

The theory of collective correlations in nuclei is extended to the nuclear continuum treating the 1p-1h dipole continuum states in the framework of the eigenchannel theory of nuclear reactions. The basis states for the diagonalization of the total Hamiltonian are obtained by coupling the 1p-1h continuum states to surface quadrupole vibrations. Numerical calculations based on two coupling schemes are performed for the giant dipole resonance in ^{12}C, taking into account the low-lying excited states of the residual nuclei by core-hole coupling. (auth)

29266 CORIOLIS-COUPLING CALCULATION OF LOW-LYING STATES IN Ru, Pd, AND Cd ISOTOPES. Imanishi, N.; Fujiwara, I., Nishi, T. (Kyoto Univ.). Nucl. Phys.; A205: No. 3, 531-544(1973).

The theoretical potential energies and level spectra are reported for odd-mass Ru, Pd and Cd nuclei. The potential energy is calculated by taking into account the blocking effect. The level spectra are obtained by considering a collective and an intrinsic degree of freedom, where the motion of an unpaired quasiparticle in Nilsson's deformed orbital is coupled by a Coriolis force with the rotational motion. For all the nuclei investigated here, the ground state spin-parity and the presence of many even-parity states and of the $11/2^-$ isomeric state are well reproduced by the model. The possible existence of shape isomeric states is suggested. (auth)

29267 EXTENSION OF THE ASYMMETRIC ROTOR WITH VARIABLE MOMENT-OF-INERTIA MODEL TOWARD QUASI-BANDS. Abecasis, S. M. (Instituto de Investigacion Aeronautica y Espacial, Buenos Aires). Nucl. Phys.; A205: No. 3, 475-480 (1973).

An extension of the AROVMI model is presented. It permits the simultaneous analysis of the ground state and γ quasi-rotational bands in all doubly even nuclei, apart from a few exceptions. (auth)

29268 GROUND STATE MOMENTS OF INERTIA OF DEFORMED NUCLEI AROUND BARIUM. Pomorski, K. (Inst. for Nuclear Research, Warsaw); Nerlo-Pomorska, B.; Ragnarsson, I.; Sheline, R. K.; Sobiczewski, A. Nucl. Phys.; A205: No. 3, 433-453(1973).

Ground state moments of inertia and collective gyromagnetic ratios of deformed even nuclei with $50 < Z, N < 82$ are calculated in the cranking-model approximation. Rather good agreement with experimental values of the moments of inertia is obtained. The dependence of the moment of inertia on the quadrupole (axial ϵ and non-axial γ) and on the hexadecapole ϵ_4 deformations is investigated. Special consideration is given to the problem of the collectivity of the moment of inertia and to its sensitivity to the single-particle scheme and the pairing-force strength. (auth)

29269 DERIVATION OF A WAVE EQUATION FOR COLLECTIVE MOTION. Hetherington, J. H. (Univ. of Copenhagen). Nucl. Phys.; A204: No. 1, 110-120(1973).

The generator coordinate method based on states derived from the random phase approximation, together with a strong assumption, leads to a differential equation for collective motion similar to the Bohr Hamiltonian with inertial parameters given by a formula related to the cranking model and with a potential almost equal to the ground state energy in the random phase approximation for each deformation. (auth)

29270 CALCULATIONS WITH REACTION MATRICES IN THE p–f SHELL. Comins, H. N. (Flinders Univ. of South Australia, Bedford Park); Hewitt, R. G. L. Aust. J. Phys.; 25: No. 6, 651-658(Dec 1972).

Elements of the shell-model reaction matrix have been calculated for the p-f shell with an exact treatment of the Pauli operator. These elements have been used in straightforward calculations of the energy levels of ^{42}Ca and ^{42}Sc and the binding energy of ^{49}Ca. (auth)

PHYSICS (PLASMA AND THERMONUCLEAR)

Confinement and Heating

29271 COLLISIONAL ABSORPTION OF FAST HYDROMAGNETIC WAVES IN A TWO-ION PLASMA. Theory. Adam, J.; Alvares de Toledo, F. (CEN, Fontenay-aux-Roses, France). Compt. Rend., Ser. B; 276: No. 1, 15-17(3 Jan 1973). (In French).

A mechanism for heating plasma ions with electromagnetic waves is presented. It can be used to rapidly raise the ion temperature of the initial containment phase of most closed configurations. The mechanism is applicable up to a few hundred electrons volts, for medium and high densities ($>10^{14}$ cm^{-3}). (FR)

29272 COLLISIONAL ABSORPTION OF FAST HYDROMAGNETIC WAVES IN A TWO-ION PLASMA. Experiment. Adam, J.; Alvarez de Toledo, F. (CEN, Fontenay-aux-Roses, France). Compt. Rend., Ser. B; 276: No. 2, 67-69(8 Jan 1973). (In French).

The excitation and damping of the first mode of a fast hydromagnetic wave in a two-ion plasma (50% H–50% D) were studied experimentally. The plasma was confined in the stator-B device, where the theoretical conditions for the excitation are fulfilled. (FR)

29273 ROLE OF FOCUSING DURING THERMOCONDUCTIVE HEATING OF A PLASMA BY HIGH-POWERED LASER RADIATION. Zakharov, S. D.; Krokhin, O. N.; Kryukov, P. G.; Tyurin, E. L. Kvantovaya Elektron. (Moscow); No. 2, 104-107(1971). (In Russian).

Ion heating in deuterium-containing plasmas by laser radiation is studied. Calculations were made for the case when the characteristic depth of wave penetration is greater than the focusing diameter of the radiation and the thermal scattering is of a spherical nature. (MOW)

29274 INCREASE IN THE EFFECTIVENESS OF THE LASER-HEATING OF PLASMA DURING THE ADDITION OF HEAVY IMPURITIES TO THE TARGET. Zakharov, S. D.; Krokhin, O. N.; Kryukov, P. G.; Tyurin, E. L. Kvantovaya Elektron. (Moscow); No. 2, 102-103(1971). (In Russian).

Laser-irradiated deuterium-containing compounds were investigated. It is shown that the addition of heavy impurities can increase the plasma ion temperature. (MOW)

29275 CONDUCTIVITY-TYPE LASER HEATING OF NONHOMOGENEOUS PLASMA. Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 20: No. 12, 963-967(1972).

The modified method of momentums is generalized to the case of thermal-conduction laser heating of nonhomogeneous plasma. General and closed-form solutions are found in the case of linear nonhomogeneity. The method described can also be applied to the problem of a spherical or cylindrical wave, with consideration of the recovered energy of fusion and, also, in the case of two-temperature plasma, in which closed-form solutions cannot be obtained; however, the results are expressed in an implicit form. (auth)

29276 PLASMA HEATING BY BEATING OF TWO LASER BEAMS. Beaudry, G.; Martineau, J. (Univ. of Quebec). Phys. Lett.; 43A: No. 4, 331-332(26 Mar 1973).

The problem of plasma wave production due to the beating of two parallel electromagnetic waves, propagating in the same and in opposite directions into an inhomogeneous plasma, is treated, taking into account the influence of collisions. (auth)

Diagnostics

29277 (COO-2229-2) ION BEAM PROBE PLASMA DIAGNOSTIC SYSTEM. Annual Progress Report for the Period 1 May 1972–31 January 1973. Hickok, R. L.; Jennings, W. C.; Huchital, G. S.; Reinovsky, R. E. (Rensselaer Polytechnic Inst., Troy, N. Y.). Mar 1973. Contract AT(11-1)-2229. 69p. Dep. NTIS $5.50.

The research can be divided into four categories: (1) Cooperative effort with PPL to extract plasma current density distribution from beam probe measurements, (2) Design of beam probe system for Doublet II, (3) Design of beam probe system for United Aircraft Research Laboratory's "Baseball" device, and (4) Experimental program at RPI to measure T_e with ion beam probe. It is shown that the non-toroidal components of the CF field on the ST Tokamak rotated and demagnified the Z displacement of the secondary ions at the detector. Furthermore, it is shown that this distortion can be subtracted out in the data reduction process. Preliminary design of a beam probe system for Doublet II, subject to the constraint of minimizing the entrance and exit ports, has been completed and shows that such a diagnostic system would permit measurements all along a line passing through the upper focal point. Considerable progress has been made on the design of a beam probe system for the UARL "Baseball" device. This design would permit measurements throughout a small volume near the center of the system using a single fixed detector. It has been shown that a two ion species beam probe system can be used to measure electron temperature in the range of 5 to 200 eV. Experimental verification at 7 eV was obtained on the RPI hollow-cathode discharge. (auth)

29278 UTILIZATION OF 1-nsec AND 5-nsec FRAMING CAMERAS IN THE STUDY OF DENSE PLASMAS. Delmare, C.; Laviron, E. (Centre d'Etudes de Limeil, Villeneuve-Saint-Georges, France). Acta Electron.; 15: No. 4, 333-340(Oct 1972). (In French).

Electronic cameras and, in particular, 1-nsec exposure time framing camera (200-psec cameras are currently being developed) were used to study the formation and expansion of high-electron-density plasmas (10^{19} to 10^{21} electrons cm^{-3}) in conjunction with photographic interferometric and schlieren techniques. Such plasmas are obtained by laser–matter interactions or a focusing discharge and have expansion velocities up to 2×10^7 cm sec^{-1}. (FR)

29279 APPLICABILITY OF FREQUENCY ANALYSIS METHODS TO EXPERIMENTAL INVESTIGATION OF CURRENT FLUCTUATION IN PLASMA. Apukhovskii, A. I. Avtomatika; 16: No. 4, 52-58(1971). (In Ukrainian).

Proceeding from the fact that current fluctuations are random stationary processes with separate distinctly pronounced frequency components, a general case is considered of the behavior of the resonator analyzer cell with supply to its input of absolutely random signal of "white noise" type. Results of processing the oscillograms with current-fluctuation data of one of the installations are presented. (auth)

29280 SPACE–TIME DISTRIBUTION OF THE OPTICAL DENSITY OF THE PLASMA IN HIGH-CURRENT Li–In DISCHARGES. Vekhov, A. A.; Nikolaev, F. A.; Rozanov, V. B. (Lebedev Inst. of Physics, Moscow). High Temp. (USSR) (Engl. Transl.); 10: No. 4, 655-658(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 728-731(1972).

The method of absorption of the beam from a He–Ne laser (λ = 6327Å, radiation power 10 mW) was used to study the space–time distribution of the optical density of lithium and indium plasmas. It is shown that the optical density of the plasma pinch is nonuniform over its radius and has a maximum at a certain distance from the discharge axis. The model of the development of the discharge is discussed according to which the plasma has a maximum temperature at the center of the discharge. (auth)

29281 DOUBLE PROBE IN A RECOMBINATIONAL PLASMA. Novikova, K. P. High Temp. (USSR) (Engl. Transl.); 10: No. 4, 798-800(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 889-891(1972).

A study was made of the possible use of a double probe to measure T_e in a collisional plasma, in which the primary mechanism for the loss of charged particles in recombination in the plasma interior. The distributions of the electron and ion densities are found near an insulated electrode at a floating potential. (MOW)

29282 MEASUREMENT OF LOCAL VELOCITY VECTOR IN PLASMA FLOWS. Kozlov, N. P.; Leskov, L. V.; Protasov, Yu. S.; Khvesyuk, V. I. (Moscow Higher Technical School). High Temp. (USSR) (Engl. Transl.); 10: No. 4, 792-793(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 884-885(1972).

The direction of the local velocity vector can be measured by means of electrostatic probes operating under conditions of saturation ion current. This method is briefly described. (MOW)

29283 DETERMINATION OF PLASMA DENSITY IN A STELLARATOR USING AN OPEN MICROWAVE RESONATOR. Auklina, D. K.; Nechaev, Yu. I.; Sud'enkov, V. Ya.; Fedyanin, O. I. (Lebedev Inst. of Physics, Moscow). High Temp. (USSR) (Engl. Transl.); 10: No. 4, 828-831(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 913-916 (1972).

The construction of the resonator is illustrated. It comprises

two spherical mirrors of radius a = 23 mm separated by a distance of 90 mm and positioned close to the inside wall of the toroidal stellarator chamber. The mirrors are set up with the aid of a threaded coupling and a thin-walled adjusting ring. The resonator is excited by a dielectric waveguide inserted in a central coupling aperture of radius a_0 = 0.8 mm. (auth)

29284 PROBE DEVICE FOR MEASURING LOCAL PARAMETERS OF IONIZED GAS FLOW. Kubarev, Yu. V.; Krasnenkov, M. A.; Korshakovskii, S. I.; Matusevich, I. M. (Moscow Inst. of Radio, Electronics, and Automation). High Temp. (USSR) (Engl. Transl.); 10: No. 4, 794-795(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 885-887(1972).

An apparatus is described for measuring, in about 0.3 sec, the temperature of electrons in the range 3 to 20 eV, charged particle concentration (10^9 to 10^{15}) cm^{-3}, and directional ion velocity (5 to 100) $\times 10^3$ m/sec. The bottom limits of ranges are determined by the resolving power of the devices and the upper limits by the design features of probes and the duration of measurements. A single Langmuir probe is used for measuring the plasma potential φ. The characteristic dimension of the probe should be much less than the mean free path of particles. The ion velocity v_i is measured by the directional probe method [3,4] in which the collecting flat surface of one of the probes is set parallel to the ionization gas current while the other is set normal to this direction. The quantities T_e, $n_{i,e.}$, φ, and v_i are calculated from the characteristics taken with probes. (MOW)

Kinetics (General)

29285 CALCULATION OF THE STATIONARY PARTICLE DISTRIBUTION IN THE ARC IN THE CASE OF AXIAL PLASMA INJECTION. Rost, L. (Bergakademie, Freiberg, Ger.). Exp. Tech. Phys.; 20: No. 4, 337-343(1972). (In German).

The stationary flow of a "thermal plasma source" axially arranged in an arc column is examined. In the case of an easily ionizable component in a nonionizable filling gas the spatial distribution of neutral atoms and ions can be calculated in the vicinity of the axis. Results of a numerical example show the behavior as known from experiments. Values for the radial space-charge field referring to the treated example are given. (auth)

29286 ENERGY ABSORPTION IN COLD INHOMOGENEOUS PLASMAS: THE HERLOFSON PARADOX. Crawford, F. W.; Harker, K. J. (Stanford Univ., CA). J. Plasma Phys.; 8: No. 3, 261-286(Dec 1972).

The Herlofson paradox is exemplified by a capacitor containing cold, collisionless, inhomogeneous plasma as the dielectric: its response to a sinusoidal driving signal can exhibit continuous energy absorption, even though the system is lossless. The underlying mechanism can be explained in terms of the transient response of the system. Several analytically tractable cases of delta-function and sinusoidal excitation are examined in detail, and the effects of collisions and nonzero electron temperature in determining the steady-state fields and dissipation are considered. Some of the practical consequences of resonant absorption are discussed and a number of paradoxical plasma phenomena elucidated. (auth)

29287 SLOWING DOWN OF AN ELECTRON BEAM IN PLASMA WITH A HIGH LEVEL OF LANGMUIR TURBULENCE. Rudakov, L. I. Dokl. Akad. Nauk SSSR; 207: No. 4, 821-823(1 Dec 1972). (In Russian).

Induced emission (instability) of Langmuir oscillations during the injection of an electron beam in a plasma in the course of a protracted period of time may lead to an accumulation of turbulence with a high energy density. The possibility of the existence of a new state of turbulence, which may arise and be sustained as a result of cluster instability under given conditions, is discussed. (KSW)

29288 INFLUENCE OF VISCOSITY ON THE MOTION OF NONUNIFORMITIES OF A NONEQUILIBRIUM PLASMA IN A MAGNETIC FIELD. Golubev, V. S.; Dan'shchikov, E. V.; Lebedev, F. V. (Moscow State Univ.). High Temp. (USSR) (Engl. Transl.); 10: No. 4, 789-791(1972).

Translated from Teplofiz. Vys. Temp.; 10: No. 4, 882-884(1972).

Consider the motion of a plasma current-carrying formation around a closed toroidal channel of length A and rectangular cross section. Current flows in the radial direction between the coaxial side walls of the channel, which serve as electrodes, and the magnetic field is parallel to the symmetry axis of the system. Let the current occupy the entire height of the channel, bounded top and bottom by dielectric walls, but be limited in the azimuthal direction to a width d < A. Outside the region in which the current flows the conductivity of the medium is taken as zero. Effects connected with the curvature of the channel are neglected. For subsonic flow the neutral gas filling the channel can be regarded as incompressible, and its velocities inside and outside the plasma formation can be taken to be equal. Some experimental data are described. (MOW)

Kinetics (Experimental)

29289 MEASUREMENT OF ION-RICH SHEATH THICKNESS BY ION ACOUSTIC WAVE. Watanabe, S.; Ishihara, O.; Tanaca, H. (Yokohama National Univ., Japan). J. Plasma Phys.; 8: No. 3, 321-330(Dec 1972).

Measurements of sheath thickness in a low-pressure plasma are reported. The sheath is ion-rich and contains both ions and electrons; the sheath edge is taken as a boundary for ion acoustic waves. The thickness of the sheath is estimated from a frequency shift of the wave. The experimentally obtained sheath boundary is in agreement with the Tonks–Langmuir value as modified by Self. (auth)

29290 INDUCED EMISSION DUE TO INTERACTION OF STRONG CURRENT RELATIVISTIC BEAM WITH PLASMA. Tkach, Yu. V.; Fainberg, Ya. B.; Magda, I. I.; Lemberg, E. A.; Gadetskii, N. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 1, 44-46(Jan 1973). (In Russian).

Generation of induced emission was studied in a plasma–beam discharge formed by a strong-current relativistic beam with current of 30 kA and energy of 0.7 MeV. The generation is obtained at wavelengths of 3159, 3371, 3577 Å belonging to the second positive system of lines N_2. Medium pumping is assumed to be realized with development of collective interaction processes of such a beam with plasma. (auth)

29291 PLASMA POLARIZATION SHIFT FOR MEMBERS OF THE RESONANCE SERIES OF IONIZED HELIUM. Gabriel, A. H.; Volonte, S. (Culham Lab., Abingdon, Eng.). Phys. Lett.; 43A: No. 4, 372-374(26 Mar 1973).

Plasma polarization shift measurements are reported for the He II resonance lines. The shifts are shown to be to the blue and are consistent with the $n^2(n^2 + 1)$ dependence predicted by Greig et al. The correction proposed by Burges and Peacock appears to underestimate the shifts, probably due to their choice of the cutoff radius. Red shifts also measured in this experiment are shown to originate in the far-wing asymmetries of the optically thick Stark-broadening resonance lines. (auth)

Kinetics (Theoretical)

Refer also to abstract 28611.

29292 ONE-DIMENSIONAL NUMERICAL EXPERIMENT ON THE ANOMALOUS RESISTANCE OF A PLASMA. Sigov, Yu. S.; Khodataev, K. V.; Khodyrev, Yu. V. (Inst. of Applied Mathematics, Moscow). Dokl. Akad. Nauk SSSR; 207: No. 1, 75-78(1 Nov 1972). (In Russian).

Results are presented from one-dimensional calculations undertaken for the purpose of demonstrating the role of nonlinear processes in the initial stages of a regime with an anomalous resistance. The behavior of a plane layer of a rarefied plasma focused on the section $-\frac{1}{2}L \le x \le \frac{1}{2}L$ and located in an outer electric field is studied. (KSW)

29293 KINETIC THEORY OF A TWO-DIMENSIONAL MAGNETIZED PLASMA. Part 3. Limit of Very Large Magnetic Field. Vahala, G. (Univ. of Tennessee, Knoxville). J. Plasma Phys.; 8: No. 3, 375-378(Dec 1972).

The BBGKY hierarchy for a two-dimensional magnetized plasma is considered in the weak-coupling and small plasma parameter limits for very large magnetic fields. The Fokker–Planck and Balescu–Lenard equations satisfy an H-theorem and conservation laws and exhibit two cutoffs related to the periodicity of the particle orbits and to the distance of closest approach of a thermal particle. (auth)

29294 NUMERICAL SIMULATION OF RELATIVISTIC ELECTRONS CONFINED IN AN AXISYMMETRIC MIRROR FIELD. Brettschneider, M.; Killeen, J.; Mirin, A. A. (Univ. of California, Livermore). J. Comput. Phys.; 11: No. 3, 360-399(Mar 1973).

A time-dependent numerical model of the Astron, with which injection and trapping can be studied in detail, is developed. Effects due to the resistors and neutralization are included. The model is

axially symmetric. The E-layer electrons are simulated by many thousands of finite-size superparticles, which move in the r–z domain and have velocity components v_r, v_θ, and v_z. The model is relativistic and the electromagnetic fields are obtained by solving four wave equations—three for the vector potential and one for the scalar potential. The E-layer current and the current induced in the resistor wires are included in the above field equations. The computed self-fields are added to the external field to give the field configuration as a function of time. Results of multiple pulse injection are presented. (auth)

29295 COLLISIONAL EFFECTS ON THE ION DISTRIBUTION FUNCTION AND POTENTIAL IN THE TONKS–LANGMUIR PLASMA SHEATH PROBLEM. Anenberg, G. L. Los Angeles; Univ. of California (1972). 193p. University Microfilms Order No. 73-6373.

Thesis (Ph.D.).

The Tonks–Langmuir plasma-sheath problem is solved with collisional effects in a planar geometry from Poisson's equation and the Boltzmann equation for the ion distribution function. Collisional terms considered in addition to ionization are recombination, charge exchange and ion–ion and ion–electron Coulomb scattering. Electrons are assumed to consist of Maxwellian electrons as well as a group of primary electrons. A set of transport equations relating the ion macroscopic variables is obtained by taking moments of the ion Boltzmann equation. The resulting open system of differential equations is truncated by assuming that the axial energy flow term takes on the collisionless form. An analytic expression for the ion distribution function is obtained by integrating Boltzmann's equation. Collisional terms for mercury and cesium were evaluated at typical operating conditions in an ion propulsion engine and compared to the "collisionless" generation term. For both plasmas, the ion–ion collision term was larger than the generation term and the ion–electron recoil term smaller. The cesium recombination and charge-exchange terms were also comparable to the generation term. Numerical solutions including the ion–ion collision term are obtained for the plasma potential and the ion density, mean velocity, and axial and transverse kinetic temperatures. Moments computed from the analytic form of the ion distribution function are shown to agree very closely to the moment terms related by the transport equations. Contours of the collisional ion distribution function are also plotted in velocity space. (Diss. Abstr. Int., B)

29296 INTIMATE PAIRS IN GUIDING-CENTER PLASMA. Williamson, J. H. (Culham Lab., Abingdon, Eng.). Phys. Lett.; 43A: No. 4, 321-322(26 Mar 1973).

The motion of closely coupled pairs of particles contributes to the diffusion across a uniform magnetic field. In two dimensions the contribution is $O(N_D^3)$ smaller than the vortex diffusion, but in three dimensions the pair diffusion coefficient is independent of the field strength B. (auth)

29297 ENERGY LOSS OF CHARGED PARTICLES IN MAXWELLIAN PLASMAS. Kammash, T.; Galbraith, D. L. (Univ. of Michigan, Ann Arbor). Nucl. Fusion; 13: No. 1, 133-138(Jan 1973).

An average energy-loss-rate calculation is given. Some measure of the numerical difference between the results and those of Butler and Buckingham (Phys. Rev., 126: 1(1962)) is given. Several cases are compared with the results of Sigmar and Joyce (Nucl. Fusion, 11: 447(1971)) in which collective effects are incorporated through the use of the Balescu–Lenard kinetic equations. (MOW)

Production

29298 FORMATION OF A FUSIONABLE PLASMA IN A HIGH-PRESSURE ARC CHANNEL. Cheng, D. Y. (Univ. of Santa Clara, CA). Nucl. Fusion; 13: No. 1, 129-133(Jan 1973).

A deuterium arc plasma channel at very high density (10^{18-19} cm^{-3}) was produced experimentally by electrically exploding a metal tube containing the deuterium. This plasma channel was formed in the central rarefaction wave region of a cylindrical shock. The expansion of the rarefaction wave behaves as a pump, which minimizes the plasma channel density at the center of the cylindrical shock. Both the density and the density gradient increase towards the shock front, very rapidly forming a density well that contains the plasma channel. Unfortunately, the well diameter increases with time. However, if the plasma experiment can be performed faster than the gas-dynamic expansion, the density well is still a good inertial confinement condition for experiments, and perhaps it should be called dynamic inertial confinement. In this experiment the density of the arc channel can be controlled and the plasma can be preferentially heated in the high-temperature region to even higher temperatures. Steps that lead to this experimental scheme are given. (auth)

29299 PLASMA GENERATOR. Ehlers, K. W. (to United States Atomic Energy Commission). U. S. Patent 3,715,625. 6 Feb 1973. Filed date 12 Jan 1971. 4p.

An apparatus for generation of dense ion–electron plasma is described. Ions are accelerated from an ion source of the apparatus through an electron-emitting filament. Electrons from the rear of the filament are abstracted to the positive ions and the combination forms a moving plasma with ions and electrons of equal velocity, the plasma forming a concentrated beam utilized for striking a desired target. (Official Gazette)

Stability

29300 EFFECTS OF COLLISIONS AND GYROVISCOSITY ON GRAVITATIONAL INSTABILITY IN A TWO-COMPONENT PLASMA. Herrnegger, F. (Univ., Innsbruck). J. Plasma Phys.; 8: No. 3, 393-400(Dec 1972).

The dispersion relation for gravitational instability is given within the framework of a two-fluid theory. It is shown that the Jeans criterion is changed by finite Larmor radius and by collisions for waves propagating perpendicularly to the magnetic field. The critical wavenumber for instability decreases with increasing Alfvén velocity and with increasing gyroviscosity. Instability does not set in with overstability. (auth)

29301 INSTABILITY OF HYDRODYNAMIC LONGITUDINAL OSCILLATIONS IN A NON-UNIFORM MAGNETOACTIVE PLASMA. Demchenko, V. V.; El-Naggar, L. A. (Atomic Energy Commission, Cairo). J. Plasma Phys., 8: No. 3, 387-391(Dec 1972).

The stability of hydrodynamic longitudinal oscillations of an inhomogeneous magnetoactive plasma is analyzed. If the non-uniformity of density is taken into account, it is shown to result in parametric-like instability at sub- and ultra-harmonics of natural plasma oscillation frequencies. The conditions for the development of unstable oscillations and their growth rates are determined. (auth)

29302 ION CYCLOTRON INSTABILITY IN CURRENT-CARRYING PLASMAS WITH ANISOTROPIC TEMPERATURES. Lee, K. F. (Environmental Research Labs., Boulder, CO). J. Plasma Phys.; 8: No. 3, 379-386(Dec 1972).

The effect of thermal anisotropies on the Drummond–Rosenbluth two-stream ion cyclotron instability is studied. The properties of the instability are found to be dependent on the ratio of parallel electron temperature to perpendicular ion temperature, $T_{\parallel e}/T_{\perp i}$. The dependence on $T_{\parallel e}/T_{\perp i}$ becomes less sensitive as the temperature ratio increases, and, in the limit of $T_{\parallel e}/T_{\perp i} \gg 1$, the instability becomes independent of the perpendicular temperatures. (auth)

29303 STABILIZATION OF THE NORMAL DRIFT MODES IN AN INHOMOGENEOUS PLASMA BY A SHEAR MAGNETIC FIELD. Tu Khiet (Paris Univ., Orsay, France). J. Phys. (Paris); 33: No. 11, 1037-1047(Nov 1972). (In French).

The stabilization effect of shear on drift waves in a low-β plasma is analyzed. It is shown that the critical shear corresponding to a complete stabilization depends on the relative number of ion Larmor radii in the density profile and on the ratio of the ion and electron masses. (FR)

29304 ROTATIONAL INSTABILITY OF HOT-CATHODE PENNING DISCHARGE PLASMA. Romanyuk, L. I.; Slobodyan, V. M. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 1, 85-91(Jan 1973). (In Russian).

By comparing the experimental data and results of the computer, numerical calculations of the dispersion equation for low-frequency oscillations with azimuthal modes m = 1, 2, 3 in a hot-cathode Penning discharge plasma are established to be a consequence of rotational instability resulting from the plasma drift in crossed radial electric and axial magnetic fields. The condition of equality of the ion azimuthal drift velocity and wave phase velocity is shown to determine a space region of the instability initiation. An attempt is made to explain qualitatively the critical magnetic fields' dependences and oscillation mode sequence, starting from a balance between the perturbation rise time and perturbation dissipation time. (auth)

29305 HIGH-FREQUENCY INSTABILITY OF AN ELECTROMAGNETIC WAVE IN A NONEQUILIBRIUM MAGNETIZED PLASMA. Rabinovich, M. I.; Fainshtein, S. M. (Gorky State

Univ., USSR). Zh. Eksp. Teor. Fiz.; 63: No. 5, 1672-1677(Nov 1972). (In Russian).

It is shown that in a nonequilibrium medium, viz, a magnetized plasma permeated by an electron beam, instability of a low-frequency electromagnetic wave should be possible that results in the excitation of two high-frequency waves and in a decrease of amplitude (decay) of the initial pumping wave. The mechanism of such instability is discussed and its increment is determined. The corresponding estimates for a laboratory plasma are presented. (auth)

29306 PLASMA INSTABILITY AND THE STRUCTURE OF STARK-BROADENED HYDROGEN LINES. Griem, H. R. (Univ. of Maryland, College Park). Comments At. Mol. Phys.; 3: No. 6, 181-186(Nov 1972).

Comments are offered on the paper by Wiese, Kelleher, and Paquette (Phys. Rev., A6: 1132(1972)) on measurements of Balmer-line profiles from a high-current, wall-stabilized arc operated in H_2 or, for the otherwise optically thick H_α line, in an $Ar-H_2$ mixture, and the finding of pronounced differences between measured and calculated profiles in and near the line centers. In the absence of relevant stability or instability experiments an instability is predicted that could invalidate the usual analyses of central profile structures from arc measurements. This is the overheating instability of ohmically heated plasmas that arises from the increase of electrical conductivity with temperature. Comments are also made on the paper by Lee (J. Phys., B4: 1640(1971)) on theoretical difficulties in obtaining a truly unified theory of spectral line broadening. (UK)

29307 STUDY OF ABSOLUTE INSTABILITIES IN MIRROR PLASMAS. Jong, R. A. Ann Arbor, MI; Univ. of Michigan (1972). 140p. University Microfilms Order No. 73-6857.

Thesis (Ph.D.).

A two-dimensional criterion for distinguishing absolute instabilities with arbitrary propagation in an infinite magnetized plasma is developed and applied to mirror-confined plasmas. It is shown that this criterion follows directly from the one-dimensional criterion by careful consideration of the singularities in the inverse Fourier–Laplace transform integrals. A number of instabilities, generally referred to as "Loss Cone" instabilities are numerically investigated using the above criterion and the results compared to those available from one-dimensional calculations where growth is restricted to the direction parallel to the magnetic field. It is found that, for the loss-cone instability, the one-dimensional calculation gives good estimates of the transition density and real parallel wave number as a function of the electron temperature, but yields an over-estimation of the maximum axial convective growth rate. When the effects of ion-temperature anisotropy are examined it is shown that the two-dimensional calculation is required because of the great and sensitive dependence of the transition density on the value of the perpendicular wave number. Although the stabilizing effect of increased electron temperature on the loss-cone, drift-cone, and drift-cyclotron instabilities is confirmed, it is found that this effect is smallest in the case of the drift-cyclotron mode. Moreover, the presence of a cool ion component in a hot loss-cone plasma is shown to have only a small stabilizing effect at the first ion cyclotron harmonic. The Dory–Guest–Harris instability associated with the ring distribution is shown to be absolute for flute-like modes, while for oblique propagation it is shown that an absolute instability cannot exist. For all modes, the one-dimensional calculation gives somewhat pessimistic results regarding the dimensions of a stable plasma. By allowing for spatial decay normal to the magnetic field, the two-dimensional investigation shows that the plasma need not be as "stubby" to be stable against the loss-cone modes. (Diss. Abstr. Int., B)

29308 STABILIZING EFFECT OF A RESISTIVE LINER ON KINK INSTABILITIES. Tanaka, M.; Tuda, T.; Takeda, T. (Japan Atomic Energy Research Inst., Tokai). Nucl. Fusion; 13: No. 1, 119-123(Jan 1973).

In most tokamak devices, a thin-walled resistive liner is placed between the plasma column and the conducting casing. The liner may stabilize the nonlocal modes because of the restoring force due to currents flowing along it. This stabilizing effect of a liner is examined here, assuming a uniform current distribution across the plasma column. Similar calculations have been done by Kruskal et al. for a skin-current configuration without a conducting casing. (MOW)

29309 NONLOCAL ASYMPTOTIC TREATMENT OF THE STABILITY OF AN INHOMOGENEOUS CONFINED PLASMA. Croci, R.; Saison, R. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). Nucl. Fusion; 13: No. 1, 81-85(Jan 1973).

The electrostatic stability of a plasma confined in a static magnetic field is considered. In Fourier space, an asymptotic method is developed that permits the study of the stability of waves with a wavelength k_x^{-1} (along the direction of the inhomogeneity) smaller than the inhomogeneity length of the plasma but arbitrarily compared to the gyration radius of the particles. As an example, the absolute drift instabilities are studied. (auth)

29310 STABILITY OF PLASMA IN HELICAL FIELD. Bhatnagar, P. L. (Univ. of Rajasthan, Jaipur, India); Srivastava, M. P. Indian J. Pure Appl. Math.; 3: No. 3, 384-395(May 1972).

Generally, the magnetic field in the containing devices is of helical type. But it is very difficult to solve the resulting equations in the presence of general axial and azimuthal fields. After establishing equations for a general helical field, the field that is constant in the axial direction is considered, and the azimuthal component is produced by a small line current as a particular case. The plasma shell of finite thickness and of infinite conductivity is taken in the presence of such a field. The normal-mode technique is applied to study the axisymmetric and azimuthal disturbances. A sixth-degree equation in frequency for the various values of parameters is obtained. In the azimuthal disturbances a neutral stability curve plotted indicates a very strong dependence of stability on the thickness of the plasma shell. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstract 28573.

29311 (CONF-720908–, pp 240-243) LARGE SUPERCONDUCTING MAGNET FOR FUSION RESEARCH. File, J.; Sheffield, G. V. (Princeton Univ., NJ). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

Fusion technology will require superconducting fields of moderately larger working volume and of moderately higher field strength (by several orders of magnitude) than previously designed. A novel design of a toroidal magnet that accommodates the large forces generated by such a magnet, was previously reported. This paper describes modifications to the coil shape required when the toroidal magnet is comprised of discrete coils as well as a segment of a toroidal system that is being constructed and, when tested, will verify the reported prescription. The coil segment has a bore approximately 1.0 m × 1.3 m and will be tested for a maximum field of 100,000 G. (auth)

29312 (CONF-720908–, pp 244-251) MATERIALS AND COST ANALYSIS OF CONSTANT-TENSION MAGNET WINDINGS FOR TOKAMAK REACTORS. Young, W. C.; Boom, R. W. (Univ. of Wisconsin, Madison). 1972.

From 4th international conference on magnet technology; Upton, New York, USA (19 Sep 1972).

In proceedings of the fourth international conference on magnet technology.

The successful design of a tokamak fusion reactor for economic power generation depends to a great extent on the costs associated with the magnets required to develop the magnetic fields. Emphasis is placed on the design of constant-tension coils in which mechanical and electrical stability are enhanced by keeping the material stresses elastic. The numerical analysis techniques used are described and the design curves, cost analyses and material requirements are presented for a magnet design for a 1000-MW electrical reactor. The toroidal magnets require approximately 15,000 tons of steel and copper. (auth)

29313 (TID-26299) CHOICE OF VACUUM WALL MATERIAL FOR A FUSION REACTOR. Dick, R.; Shober, T.; Weiss, J. (Argonne National Lab., Ill.). 22 Jul 1971. 80p. Dep. NTIS $6.00.

The refractory metals titanium, tantalum, niobium, molybdenum, vanadium, tungsten, and zirconium were evaluated for suitability for the vacuum wall of a fusion reactor. It was assumed that the blanket material was lithium, and that the temperature range of operation was from 600 to 1000°C. The materials were evaluated by lithium corrosion resistance, mechanical and thermal properties, and radiation effects for both the surface and volume regions. A model for the reactor was not assumed and therefore the results are presented as individual properties. Suggestions are made for future work or data needed for evaluation. (auth)

29314 OUTLOOK FOR CONTROLLED FUSION POWER. Tuck, J. Arch. Energiewirt.; No. 2, 998-1011(1972). (In German).

There are four types of fusion reactor that are most likely contenders for the production of fusion power. All fusion-reactor approaches have unsolved problems and their problems differ greatly. Nonetheless, it seems likely that, out of the diversity, one at least will succeed and it is estimated that fusion reactors are likely to start to take over from fission in the year 2,000. The production of helium as a byproduct of fusion reactors is not considered to be important but, on the other hand, the total inventory in the superconducting installations of fusion reactors could be comparable to present world reserves and gives cause for some concern. (GF)

29315 PROBLEMS OF A FUSION REACTOR. Jordan, H. L. (Kernforschungsanlage, Juelich, Ger.). Elektrotech. Z., A; 95: No. 5, 258-264(1971). (In German).

A D–T-fueled toroidal reactor is discussed. The introduction of fuel, removal of helium, and separation of T in the reaction zone are problems considered. Magnetic field production and maintenance, wall temperatures, and other thermodynamic problems are considered. (TSS)

29316 SOME RESONANT PHENOMENA IN A ONE-TURN HELICAL MAGNETIC CONFIGURATION. Demchenko, V. V.; El-Naggar, I. A.; Hussein, A. M. (Atomic Energy Authority, Cairo). Nucl. Fusion; 13: No. 1, 123-127(Jan 1973).

Because of the nonlinear character of the equations governing the magnetic lines of force (MLF), firstly, the frequency of rotation about the magnetic axis may essentially change, thus leading to the variation of the rotational transform mean angle and, secondly, provided certain relationships between the helical magnetic configuration parameters hold, the co-ordinates of the MLF tend to increase infinitely, a fact that might be interpreted as the decay of magnetic surfaces. The physical significance of this phenomenon and the mechanism that limits the increase of the MLF co-ordinates are discussed. (MOW)

29317 TEMPERATURE PROFILE IN A THERMONUCLEAR REACTOR. Verboom, G. K.; Rem, J. (FOM-Instituut voor Plasmafysica, Jutphaas, Netherlands). Nucl. Fusion; 13: No. 1, 69-79(Jan 1973).

The problem of a steady-state infinitely long plasma cylinder is considered in which nuclear reactions take place. The analysis is restricted to the fully ionized region, but the temperature at the "wall" is sufficiently low, so that nuclear energy is liberated only in the center. Of all possible nuclear reactions at axis temperature of 10^8 to 10^9°K, only the D–T reaction is considered (50/50 mixture). The energy is carried away by bremsstrahlung, re-absorption of which is neglected, and by heat conduction to the wall. An externally applied axial magnetic field (between 3 and 10 tesla at the "wall") perpendicular to the radial temperature gradient gives rise to a large diamagnetic azimuthal current, as a result of which the pressure at the boundary is much lower than in the center (e.g., 10^{-1} and 100 atm, respectively). The fuel supply and the ash removal take place through classical diffusion to and from the "wall" through this low-pressure region. The macroscopic equations are solved for a number of values of the parameters involved. No acceptable solution exists if the helium density in the center is either too low or too high, but it must be higher than the deuterium–tritium density. Solutions with a power production up to 1 GW per meter length and a plasma radius of up to a few meters are found. (auth)

Wave Phenomena

29318 PLANE LINEAR RADIATION MAGNETOGASDYNAMIC WAVES. Bhutani, O. P.; Raman, L. Int. J. Eng. Sci., 9: No. 6: 537-545(Jun 1971).

Effects of radiation, compressibility, and finite electrical conductivity on the propagation of plane and cylindrical waves in a slightly disturbed rectilinearly flowing plasma are investigated using the asymptotic technique developed by Lagerstrom, Cole, and Trilling. The dispersion relation is determined and the phase velocity diagram is presented for a selected combination of parameters. The results show that the transverse mode is not affected by radiation, while the effect on the longitudinal mode is to impose a general diffusion pattern with the diffusion coefficient depending on the Mach numbers and the external magnetic field. Several other interesting results are presented as well. (App. Mech. Rev.)

29319 PLANE-WAVE PROPAGATION IN A PLASMA SUBJECTED TO A UNIFORM MAGNETIC FIELD. Agostinelli, C. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Natur.; 48: No. 3, 334-342(Mar 1970). (In Italian).

Plane-wave propagation in a homogeneous plasma in a uniform magnetic field is considered for the cases where the effect of ion–electron collisions is neglected and the reaction of the electrons is equivalent to a pressure that depends on the variation of electron density. (auth)

29320 GENERAL THREE-DIMENSIONAL WAVE PROPAGATION IN RADIATION MAGNETOGASDYNAMICS. Bhutani, O. P.; Raman, L. Int. J. Eng. Sci.; 9: No. 6, 521-536(Jun 1971).

Effects of finite electrical conductivity and radiation on plane and cylindrical wave motion are investigated using analytical and numerical extensions of a method of Banos. It is shown that radiation affects the three pressure modes, but not the velocity modes, and leads to an entirely new mode of propagation that depends very little on the strength of the magnetic field. In the case of cylindrical waves, it is shown that the radiation-induced modified sound and Alfvén waves can propagate for all values of the transverse wave number, a result that has no counterpart in conventional magnetohydrodynamics. (App. Mech. Rev.)

29321 PROPAGATION OF ELECTRONIC LONGITUDINAL MODES IN A NON-MAXWELLIAN PLASMA. Henry, D.; Treguier, J. P. (Centre National d'Etudes des Telecommunications, Lannion, France). J. Plasma Phys.; 8: No. 3, 311-319(Dec 1972).

The experimental modifications of the classical Landau mode (occurrence of a new propagating mode below the plasma frequency) are due to a peculiar distribution function. This distribution function is approximated by a simple model (i.e., a Maxwellian function plus a water-bag function). A numerical calculation with this model gives new dispersion curves, which agree with experiment. (auth)

29322 EFFECT OF THE PLASMA INHOMOGENEITY ON THE NONLINEAR DAMPING OF MONOCHROMATIC WAVES. Asseo, E. (Observatoire de Paris, Meudon, France); Laval, G.; Pellat, R.; Welti, R.; Roux, A. J. Plasma Phys.; 8: No. 3, 341-355(Dec 1972).

The resonant interaction of particles with a monochromatic wave in an inhomogeneous plasma is studied. The effects of the inhomogeneity are represented by a variable phase velocity of the wave. This introduces, in the wave frame, an inertial force due to the non-Galilean transformation of coordinates. Asymptotic expressions are obtained for the spatial damping coefficient of the wave in two physically different cases. (auth)

29323 PROPAGATION OF SURFACE WAVES AND INSTABILITY WAVE GROWTH IN AN ION BEAM-PLASMA SYSTEM. Brakenhoff, G. J.; Baan, A.; Matitti, T. (Instituut voor Atoom en Molecuulfysica, Amsterdam). Plasma Phys.; 15: No. 3, 157-169(Mar 1973).

The system of a slowly diverging low density He^+ ion beam (energy 20 keV), traversing a stationary plasma column created by the beam itself through collisional ionization is studied. No magnetic field is present and within the limits of the detector sensitivity, no spontaneous instabilities are observed. The propagation characteristics of waves excited from the outside are investigated with an interferometer technique. The existence of propagation in the surface wave mode on the beam–plasma column is observed. From the dispersion in and opposite to the ion beam direction, a value for the plasma density is determined. (auth)

29324 EFFECTS OF PLASMA TEMPERATURE ON THE FREQUENCY SHIFT IN RESONANT CAVITIES. Saison, R. (CEN, Grenoble, France). Plasma Phys.; 15: No. 3, 171-175 (Mar 1973).

By solving the eigenvalue problem for the TM_{010} mode, it is suggested that the lack of a frequency shift in experiments with warm anisotropic plasma in a resonant cavity is unlikely to be due to some anisotropic temperature effect connected with the TM_{010} mode. It is suggested that other factors, such as possibly non-negligible Debye lengths, should be considered. (UK)

29325 DAMPING OF PLASMA WAVES IN THE LOWER HYBRID FREQUENCY RANGE. Pesic, S. S. (CEN, Grenoble, France). Plasma Phys.; 15: No. 3, 193-209(Mar 1973).

The complete dispersion equation governing small-amplitude quasilongitudinal oscillations of hot homogeneous anisotropic plasma has been solved numerically for a wide range of plasma parameters. Temporal damping rates of stable eigen oscillations and spatial damping rates of externally driven plasma waves are given. The lower hybrid dispersion curves are presented. The straight-line orbit approximation and the influence of distant collisions on the ion resonant interaction are discussed. The results obtained indicate that the wave energy is preferentially given to the ion perpendicular motion while an efficient energy transfer to the electrons requires a large electron velocity spread along the field lines. (auth)

29326 DIFFRACTION OF FAST MAGNETO-ACOUSTIC WAVES BY A PLASMA LAYER OF A PERIODICALLY VARYING DENSITY. Zoler, D. (Technical and Physical Research Centre, Iasi); Burdujan, I. Physica; 63: No. 1, 163-171(1 Jan 1973).

Expressions for the plasma perturbations in the diffracted magneto-acoustic wave are obtained. It turns out that the main maximum has exactly the same position for the perturbation in the magnetic field, in the density, and in the velocity of the plasma particles, while the secondary maxima are at different positions for each of these perturbations. (auth)

29327 ION SURFACE WAVES ON BOUNDED WARM PLASMA. Zhelyazkov, I.; Nenovski, P. (Univ., Sofia). Physica; 63: No. 1, 182-190(1 Jan 1973).

The dispersion equation of ion surface waves propagating along the boundary of a plasma (dielectric) layer is analyzed. The results obtained show that in the case of a plasma layer bounded by dielectrics or a dielectric layer bounded by plasmas the existence of surface ion plasma oscillations of frequency higher than $\omega_{pi}/(1+\epsilon)^{1/2}$ is possible, ω_{pi} being the ion plasma frequency and ϵ the dielectric permittivity. (auth)

29328 DISPERSION THEORY OF SURFACE WAVES OF AN INHOMOGENEOUS PLASMA LOCATED IN A STRONG HIGH-FREQUENCY FIELD. Aliev, Yu. M.; Gradov, O. M.; Kirii, A. Yu. Zh. Prikl. Mekh. Tekh. Fiz.; No. 1, 11-14(1973). (In Russian).

The spectra of the natural surface oscillations and the stability of a plasma are examined. The plasma nonuniformity leads to emergence of a spatial dispersion and specific attenuation of the stable oscillations of the plasma in the external high-frequency field, the frequency of which significantly increased the plasma frequency. The resulting theory of parametric resonance is developed for the frequency of the electronic surface oscillations, allowing for the nonhomogeneity of the plasma. (tr-auth)

29329 OSCILLATIONS OF AN INHOMOGENEOUS PLASMA SLAB. Ray, T. (Panskura B. Coll., India). Indian J. Phys.; 46: No. 6, 271-276(Jun 1972).

Quasi-static waves in a magnetoplasma slab with density variation along the static magnetic field were considered. An approximate dispersion relation is obtained by variational method with the use of a dielectric tensor valid for low temperature of the plasma, and it is compared with the case of a homogeneous plasma slab. (auth)

29330 ENERGY–MOMENTUM TENSOR FOR AN ELECTROMAGNETIC WAVE IN PLASMA. Klima, R.; Petrzilka, V. A. (Inst. of Plasma Physics, Prague). Phys. Lett., A.; 43A: No. 2, 151-152(26 Feb 1973).

The energy–momentum tensor is derived for a plane quasi-monochromatic wave packet of an electromagnetic wave in cold collisionless nonmagnetized plasma. A comparison with previous results indicates the relevance of the nonlinear motion in the direction of wave propagation. (auth)

29331 COVARIANT FORMULATION OF WAVE DISPERSION. Melrose, D. B. (Australian National Univ., Canberra). Plasma Phys.; 15: No. 2, 99-106(Feb 1973).

A manifestly gauge invariant and covariant description of the response of a plasma to an electromagnetic disturbance is constructed and used to deduce how the dielectric tensor transforms under a Lorentz transformation. A method for deducing the properties of waves in an arbitrary frame and an arbitrary gauge is presented. (auth)

29332 COMPLETE ISO-THERMALIZATION BY COLLECTIVE ELECTROMAGNETIC INTERACTIONS OF STRONGLY ANISOTROPIC MAGNETIZED COLLISIONLESS PLASMAS. Cuperman, S.; Salu, Y. (Tel Aviv Univ., Israel). Plasma Phys.; 15: No. 2, 107-111(Feb 1973).

The iso-thermalization of strongly anisothermal magnetized collisionless plasmas by collective electromagnetic interactions is investigated with the aid of particle-in-cell simulation methods. The iso-thermalization process is found to be strongly dependent on the initial ratio of the two temperatures involved—the higher the ratio, the stronger the relaxation. For sufficiently large values of the ratio the iso-thermalization is complete. The time evolution of the instability (i.e., the buildup and decay of the electromagnetic turbulence) and of the particle relaxation (iso-thermalization) for several initial conditions is presented and discussed. (auth)

29333 DYNAMICS OF THE NONLINEAR INTERACTION OF MAGNETOHYDRODYNAMIC WAVES. Karplyuk, K. S.; Oraevskii, V. N.; Pavlenko, V. P. (Inst. of Nuclear Research, Kiev). Plasma Phys.; 15: No. 2, 113-124(Feb 1973).

The dynamics of four nonlinearly interacting coherent magneto-hydrodynamic waves (plasmons) is investigated. Exact analytical solutions are obtained that describe the time behavior of the amplitudes and phases of the waves. The analysis of the solutions shows that they vary periodically. The periods of variation are also found for various types of coherent interacting MHD waves. (auth)

29334 PROPERTIES OF AN ELECTRON PLASMA IN A STRONG ELECTROMAGNETIC FIELD. Bass, F. G. (Inst. of Radio Physics and Electronics, Kharkov). Zh. Eksp. Teor. Fiz.; 63: No. 5, 1664-1671(Nov 1972). (In Russian).

It is shown that an electron plasma in a periodic strong electromagnetic high-frequency field (pumping field) behaves, with respect to a weak low-frequency electromagnetic wave, as a single crystal. Dispersion properties of the weak electromagnetic wave are investigated, and the possibility of specific resonances and of parametric amplification is noted. The electron energy spectrum in the pumping field is studied. (auth)

29335 EFFECT OF DISPERSION ON NONLINEAR EVOLUTION OF QUASI-MONOCHROMATIC HELICAL WAVES IN A MAGNETOACTIVE PLASMA. Istomin, Ya. N.; Karpman, V. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Zh. Eksp. Teor. Fiz.; 63: No. 5, 1698-1705(Nov 1972). (In Russian).

The joint manifestation of dispersion and nonlinear effects in the evolution of quasi-monochromatic helicons in a magnetoactive plasma is investigated. (Nonlinear effects due to cyclotron interaction between the wave and resonant particles are implied.) It is shown that, for sufficiently large wave amplitudes, dispersion becomes important. Stationary waves of the envelopes are investigated. In the case studied, they have the form of shock waves with an oscillatory structure behind the wave front. (auth)

29336 METHOD OF CYCLIC CANONICAL VARIABLES FOR CALCULATION OF ELECTROSTATIC PLASMA WAVES. Lacina, J. (Inst. of Plasma Physics, Prague). Czech. J. Phys.; 23: No. 3, 306-316(1973).

A method is derived, in which cyclic canonical variables (the generalized momenta of which are constants of the unperturbed motion) are used, for the calculation of the oscillations of a collisionless plasma in external fields. The plasma and the fields are assumed to be generally inhomogeneous. In the approximation of an electrostatic plane wave propagating in the plasma, a general dispersion equation for a weakly inhomogeneous plasma is then derived. The advantage of this method is in its great simplicity in contrast with the usual approach, where the x, v-"representation" is used. Moreover, all results are given in a simple, symmetric form. The application of this method is especially convenient for plasmas confined by external fields to a finite volume. (auth)

29337 LABORATORY STUDY OF HIGH-β COLLISION-FREE PLASMA SHOCK WAVES. Destler, W. W. Ithaca, NY; Cornell Univ. (1972). 127p. University Microfilms Order No. 73-7131.

Thesis (Ph.D.).

High-β plasma shock waves have been generated and studied in the laboratory. These shocks are roughly stationary in the laboratory frame of reference and are held for many times a typical ion gyro period. While collisions appear to play a role in the heating of the electrons, they are clearly unable to explain the ion thermalization. As the shocks studied are fast and supercritical, the ion heating accounts for the majority of the dissipation of upstream flow energy into thermal energy behind the shock. As a result, these shocks may be considered to be collision-free, in that collisionless processes play the major role in producing shock dissipation. The following conclusions may be drawn from the experimental shock studies: (1) The changes in conditions across the shock wave agree well with those predicted by the MHD one-dimensional shock conservation relations. The differences in shock structure from the idealized MHD shock appear to be largely the result of the 3-dimensionality of the experiment. (2) The shock waves studied in the laboratory are nonstationary on the time scale of an ion gyro period. This nonstationary behavior agrees well with that predicted by computer simulations where ion gyro motion was included and is not inconsistent with satellite observations of the behavior of the earth's bow shock. (3) Ion gyro effects appear to play an important role in ion thermalization. It is believed that ion gyro effects produce a coarse-graining of the ion velocity distribution and that electrostatic fluctuations may then help smooth the distribution function of the ions to a final equilibrium state. In the experiment it appears that neither ion gyro effects nor electrostatic turbulence alone are sufficiently strong to account for the observed shock dissipation. (Diss. Abstr. Int., B)

29338 INTERACTION TO SECOND ORDER OF ELECTROSTATIC AND ELECTROMAGNETIC FIELDS WITH A SEMI-INFINITE PLASMA. Zawadzki, E. M. San Diego, CA; Univ. of California (1972). 110p. University Microfilms Order No. 73-5281.

Thesis (Ph.D.).

The penetration of an obliquely incident electromagnetic wave and a normally incident electrostatic field into a hot, semi-infinite plasma is studied to second order in perturbation theory using a secularity-free reformulation of the Vlasov equation. For electrostatic excitation a comparison is made of results for a Maxwellian distribution of electron velocities and for a step distribution, or "water bag" model. Explicit results are displayed for the linear first-order field and the second harmonic. Formation of a narrow sheet of electrons near the boundary is a feature of the second order dc field. Propagating first-order modes, in addition to the usual plasma wave, are determined by numerical analysis and compared with asymptotic theoretical results. A relativistic version of the reformulated Vlasov equation is derived for the study of transverse waves in unmagnetized plasma, and comparison is made between the relativistic dispersion relation and the often-used nonrelativistic form. It is shown that use of the nonrelativistic relation leads to a temperature correction of the wrong sign, even at low temperatures where relativistic effects are usually considered negligible. Expressions for the field amplitudes and reflection coefficient are displayed in the first-order study. The first-order longitudinal and transverse waves excited by the incident em field interact to produce both electrostatic and electromagnetic second harmonics. Approximations to convolution integrals are made, enabling reduction of the general expressions for harmonic fields to two specific types of interaction: an electrostatic second harmonic is derived from interaction of the dominant linear transverse wave in the plasma with itself, and an electromagnetic second harmonic results from interaction between the dominant linear transverse and longitudinal waves. Finally, replacement of applied fields with equivalent charge and current sources on the boundary is discussed and extended to use in plasma kinetic theory. (Diss. Abstr. Int., B)

29339 SCATTERING OF ELECTROMAGNETIC WAVES BY PLASMA CONTAINERS. Sharma, S. C.; Verma, J. S. (Birla Inst. of Tech. and Science, Pilani, India). Indian J. Pure Appl. Phys.; 10: No. 9, 641-644(Sep 1972).

Expressions are derived for theoretical evaluation of the scattering cross section (σ) for a thin plasma conical shell. Values of σ are computed assuming suitable values for the different plasma parameters and presented as a function of the angle of incidence of the wave and the cone angle of the shell. It is observed that only the dielectric constant of the plasma and the thickness of the shell affect the value of σ. (auth)

29340 CONDUCTIVITY TENSOR AND DISPERSION EQUATION FOR COLLISIONAL MAGNETOACTIVE PLASMA. Khandpur, G. K. (Agrawal Coll., Jaipur, India); Varma, N. L. Physica; 63: No. 2, 404-417(15 Jan 1973).

The general dispersion relation for plasma waves propagating in an arbitrary direction with respect to a homogeneous external magnetic field in an infinite collisional plasma is derived. The collision term is assumed to be small and is taken according to a simplified Bhatnagar, Gross and Krook model. The propagation of waves is first studied for a longitudinal magnetic field; the waves are then found to be composed of a linearly polarized and two circularly polarized modes. For a transverse magnetic field the dispersion relation is obtained for linearly polarized transverse waves, as well as for coupled longitudinal–transverse waves. The effect of collisions in a weak magnetic field is discussed. (auth)

29341 ELECTROMAGNETIC EFFECTS ON ELECTROSTATIC MODES IN A MAGNETIZED PLASMA. Callen, J. D. (Massachusetts Inst. of Tech., Cambridge); Guest, G. E. Nucl. Fusion; 13: No. 1, 87-110(Jan 1973).

The complete dispersion relation governing longitudinal and transverse waves in an infinite, homogeneous magnetized plasma is discussed for arbitrary directions of wave propagation. Various forms suitable for computing modifications of the electrostatic dispersion relation arising from the coupling to transverse waves when $\omega_{pe} \gtrsim ck$ are compared. The modifications that arise for electrostatic ion gyroharmonic instabilities are determined in an ordering scheme appropriate for the important unstable modes of a mirror-confined thermonuclear plasma. The resultant effects on a number of electrostatic modes are discussed. (auth)

29342 INTERMITTENT GENERATION OF MICROWAVE OSCILLATIONS THROUGH A PLASMA–BEAM INTERACTION. Levitskii, S. M.; Shapoval, V. Z. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 17: No. 7, 1131-1137(Jul 1972).

Translated from Radiotekh. Elektron.; 17: No. 7, 1445-1451 (Jul 1972).

When an electron beam interacts with the beam plasma formed by it, under certain conditions an intermittent generation of microwave oscillations is observed. The cause of the intermittent generation is assumed to be heating of the plasma electrons by the microwave oscillations. Because of this the ambipolar diffusion rate increases, and the charge density in the plasma decreases and becomes less than the critical value so that the oscillation ceases. The oscillation resumes only after the plasma parameters are restored to their initial values. (auth)

29343 SCATTERING BY NONCONCENTRIC CIRCULAR PLASMA CYLINDERS WITH AXIAL MAGNETIC FIELDS. Okamoto, N. (Shizuoka Univ., Hamamatsu, Japan). IEEE(Inst. Elec. Electron. Eng.), Trans. Antennas Propagation; AP-21: No. 1, 128-131(Jan 1973).

Matrix equations are given for solving the problem of scattering by a plasma cylinder surrounded by another plasma layer with an axial static magnetic field. The cylinders are assumed to be normally illuminated by an H wave. The numerical calculations were performed for nonconcentric circular plasma cylinders and the scattering properties of interest are also shown. (auth)

29344 SOLUTIONS OF THE COUPLED SYSTEM OF OSCILLATORS AND ELECTROMAGNETIC FIELDS EXCITED BY AN EXTERNAL CHARGE. de Vooght, J. G. (Univ., Liege). Ann. Phys. (N. Y.); 75: No. 1, 249-294(Jan 1973).

A systematic study of the longitudinal, transverse, and total solutions of a coupled system of oscillators and electromagnetic fields in the presence of an external point charge is carried out. The space–time dependence of the solutions as well as their values in specific cases and asymptotic behavior are analyzed. It is shown that, in general, the longitudinal fields show two well-defined contributions: (a) a symmetric field surrounding the particle and carried convectively which is interpreted as a screening field; and (b) an excitation defined in principle in a whole semispace and identified with an oscillator plasma wave. The transverse solutions appear as differences between the fields given in Fermi's macroscopic theory of energy losses and the longitudinal solutions. Using complex-variable methods, it is shown how one can separate the total perturbations created by the particle in a medium represented by oscillators into three intimately related contributions: screening, oscillator-plasma excitation, and Cherenkov radiation. The space–time configurations of these fields and their relation to the longitudinal solutions and their evolution for different ranges of the velocity of the particle are given. The problem of the energy loss associated with the creation of the plasma wave is treated. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 28267 and 29054.

29345 (AD-748888) NEUTRON AND GAMMA-RAY ENVIRONMENTS FOR POINT NEUTRON SOURCES IN AN AIR-OVER-GROUND GEOMETRY. Volume I. Technical Operating Report. Beck, R. I.; Brown, W. W. (Aerospace Crop., San Bernadino, Calif.). 12 Jul 1971. Contract F04701-71-C-0172. 374p. (SAMSO-TR-72-221(Vol.1)). NTIS.

A complete graphical presentation is given of an Oak Ridge transport calculation of the nuclear environment at the air-earth interface generated by point sources of monoenergetic neutrons. Monte Carlo methods were employed in the calculations (computer codes 05R and OGRE). The graphs contain the time, energy, angular, and spatial distributions of the gamma rays and neutrons from each of 8 monoenergetic sources ranging from 0.1 to 15 MeV. The calculations extend out to 1375 m from the source. The graphical form is suitable for synthesizing the environment from a source of nuclear weapon neutrons of any spectral distribution. Only neutrons with energies above 0.1 MeV are considered in this portion of the calculation. Thermal neutrons and the gamma rays transport calculation (computer code DOT) appear in further volumes under this same title. A description of the calculations and the resultant neutron environments appear in the report. (auth) (NTIS)

29346 (AD-748889) NEUTRON AND GAMMA-RAY ENVIRONMENTS FOR POINT NEUTRON SOURCES IN AN AIR-OVER-GROUND GEOMETRY. Volume II. Beck, R. I.; Brown, W. W. (Aerospace Corp., San Bernardino, Calif.). 12 Jul 1971. Contract F04701-71-C-0172. 467p. (SAMSO-TR-72-221(Vol.2)). NTIS.

A complete graphical presentation is given of an Oak Ridge transport calculation of the nuclear environment at the air-earth interface generated by point sources of monoenergetic neutrons. Monte Carlo methods were employed in the calculations (computer codes, 05R and OGRE). The graphs contain the time, energy, angular and spatial distributions of the gamma rays and neutrons from each of 8 monoenergetic sources ranging from 0.1 to 15 MeV. The calculations extend out to 1375 m from the source. The graphical form is suitable for synthesizing the environment from a source of nuclear weapon neutrons of any spectral distribution. Only neutrons with energies above 0.1 MeV are considered in this portion of the calculation. Thermal neutrons and the gamma rays resulting from their capture are included in the graphs of a discrete ordinate transport calculation (computer code DOT) to appear in further volumes under this same title. The attending secondary gamma ray environments are presented. (auth)

29347 (AEC-tr-7415, pp 201-204) FINDING THE COEFFICIENTS OF ANALYTICAL APPROXIMATION OF THE CROSS SECTIONS OF INTERACTIONS OF γ QUANTA WITH BIOLOGICAL TISSUE. Kopytkin, Yu. V.; Speranskii, S. A. (Gorky State Medical Inst., USSR). Feb 1973. Translated from Radiobiologiya; 12: No. 5, 785-788(1972).

The coefficient of approximation in Compton scattering and photoabsorption for four types of biological tissues of the human body were found: muscles, fat, bones, lungs. The data obtained can be used to investigate the energy composition of the γ radiation that has passed through biological tissue. (auth)

29348 DOPPLER-SHIFT ATTENUATION MEASUREMENTS. Winterbon, K. B. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys.; 50: No. 24, 3147-3151(15 Dec 1972). (AECL-4327).

An improved analysis of Doppler-shifted γ spectra is outlined. This analysis is exact within the Lindhard theory of slowing down of heavy ions in solids. With an approximate cross section applicable at low energies, the equations become independent of the energy, except as a scaling parameter, and depend only on the projectile-target mass ratio. A set of universal curves of the mean fractional shift $F(\tau)$ is calculated in this approximation for several values of the mass ratio. (auth)

29349 DOSE TO STANDARD REFERENCE MAN FROM EXTERNAL SOURCES OF MONOENERGETIC PHOTONS. Jones, T. D.; Auxier, J. A.; Snyder, W. S.; Warner, G. G. (Oak Ridge National Lab., TN). Health Phys.; 24: No. 2, 241-255(Feb 1973).

Dose as a function of depth and doses to many organs of the body have been computed for broad, parallel beams of monoenergetic photons, unilaterally incident on the anterior, posterior, and left side of a "standard human." Doses to various red marrow centers are also presented, and a comparison is given to dose at a penetration depth of 5 cm, which many radiotherapists assume to represent adequately the dose to the complete marrow system. These results indicate that this "rule of thumb" is inaccurate (i.e., not better than a factor of 2). (auth)

29350 DISTRIBUTION OF ABSORBED DOSE OF α RADIATION BY TISSUE DEPTH. Andreev, S. V. (Central Inst. of Physiology and Physiotherapy, Moscow). Med. Radiol.; 18: No. 2, 36-40(Feb 1972). (In Russian).

A method is described and coefficients are given for calculation of absorbed doses formed by layers of different thickness containing α-emitting isotopes at different depths of the tissue or substance. Experimental check-up revealed complete coincidence of practical and theoretical values of dose characteristics of irradiation. (auth)

29351 CALCULATION OF DEPTH DOSES IN TISSUE WITH OBLIQUE INCIDENCE OF NEUTRONS. Ivanov, V. N.; Parfenov, E. N.; Ryabukhih, Yu. S. Med. Radiol.; 18: No. 2, 54-59(Feb 1972). (In Russian).

Depth doses were calculated in the tissue with an oblique incidence of a broad beam of neutrons onto a 30 cm thick tissue plate. The initial neutron energy levels were 1 MeV, 500 keV, 100 keV, 20 keV, 5 keV, and 100 eV. The angles of the neutrons beam incidence were 30, 45, 60, and 75° with the normal to the tissue surface. The dose of recoil protons, that of heavy recoil nuclei and the number of neutrons going through an energy of 1 eV when slowing down were calculated by using a variant of the Monte Carlo method with conditional absorption of particles. The dose components of thermal neutrons were determined to an approximation of the one-velocity group. Data of this kind are necessary for the solution of dosimetric problems of the neutron-capture therapy. (auth)

29352 DEPTH DOSE DETERMINATIONS. 3. Standard Man Phantom and Various Gamma Sources. Frigerio, N. A.; Coley, R. F. (Argonne National Lab., IL). Phys. Med. Biol.; 18: No. 2, 187-194(Mar 1973).

Applications of Monte Carlo computations to a number of depth-dose situations are illustrated by comparisons of program output with a number of simple and complex experiments. Comparisons are also made with the computations of other workers, using their simplified geometries and abbreviated compositions for man-like phantoms. Absorbed fractions, dose distributions and photon spectra are presented for a 70 kg heterogeneous Standard Man, using the ICRP composition for the eleven most prevalent elements in each of twenty-nine body regions, and air composition in the two lungs. The effects of changes in density, geometry and composition were compared with effects predicted on the basis of simplified models. Absorbed fractions, fraction first collisions, exit γ-energies and fractions are presented as a function of E_γ, for internal point and uniform sources, from 0.040 to 8.0 MeV. Depth-dose distributions are also given for a ^{252}Cf implanted source, and for a ^{60}Co therapy unit. (auth)

29353 MEASUREMENT OF THE TOTAL ATTENUATION COEFFICIENTS OF 25.8 keV PHOTONS IN Al, Cu, Ag, Sn, AND Pb. Sahota, H. S. (Punjabi Univ., Patiala, India). Indian J. Phys.; 46: No. 11, 526-527(Nov 1972).

Some attenuation coefficients are reported for low-energy photons, measured in narrow-beam geometry using a proportional counter and a radioactive isotope as a source of x rays. (WDM)

29354 EFFECT OF SHADOW TRAYS ON SURFACE DOSE AND BUILDUP FOR MEGAVOLTAGE RADIATION. Rao, P. S.; Pillai, K.; Gregg, E. C. (Case Western Reserve Univ., Cleveland). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 117: No. 1, 168-177(Jan 1973).

Using LiF powder, the surface dose and buildup were measured in a lucite phantom for several kinds of megavoltage radiation, with the purpose of determining the extent of electron contamination from plastic shadow trays. For the 6 MV unit, a shadow tray at 29 cm from the phantom caused considerable contamination of the beam, leading to an increase in surface dose of up to approximately 48% of local dose for large fields. To eliminate this, different kinds of shadow trays were tried, as well as a lead filter under the tray. The last was found to be most efficient. For the 2 MV unit an inherently good geometry led to low electron contamination, while for the cobalt 60 unit poor geometry led to high contamination. (auth)

29355 ILLUSTRATION OF ISODOSE CURVES WITH THE APPLICATION OF THE SABATTIER EFFECT. Alaniz-Camino, F.; Espejo, D. (Hospital San Jose, Monterrey, Mex.). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 117: No. 1, 202-204(Jan 1973).

A qualitative illustration is presented of the distribution of radiation around an afterloading linear applicator with cesium-137 source using the photographic phenomenon of solarization. (MHR)

29356 ANALYSIS OF RADIATION FROM A LINE SOURCE USING THE TRANSMISSION MATRIX METHOD. Hiranuma, H. Ames, IA; Iowa State Univ. (1972). 104p. University Microfilms Order No. 73-3892.

Thesis (Ph.D.).

The concept of a point kernel method was applied to the analysis of gamma ray radiation from a line source. For the investigation of radiation from an isotropic uniform line source the asymptotic form of the point matrix kernel, which had been derived from the transmission matrix method originally developed for plane geometry, was used. The calculation results were obtained as differential energy spectra and buildup factors for several materials. The calculation of the point matrix kernel for the line source analysis contains the modified secant integral, $\int_0^{\theta_0} \sec\theta \exp(-x \sec\theta)\, d\theta$. The integral has been evaluated by use of the Gaussian quadrature with check by use of the polynomial expansions. The distinct advantages of the point matrix kernel are that it can be used not only for point source analyses but also for other source geometry analysis such as line source, cylindrical volume source and spherical volume source analysis, and that it can easily overcome the weakness of the scalar point kernel which needs appropriate buildup factors. This point kernel method can be conveniently used in parametric and optimization studies. (Diss. Abstr. Int., B)

29357 CALCULATION OF PROPORTIONAL COUNTER ENERGY DEPOSITION SPECTRA FROM EXPERIMENTAL DATA. Steigerwalt, J. E.; Baily, N. A. (Univ. of California, San Diego, La Jolla). Radiat. Res.; 53: No. 1, 1-14(Jan 1973).

Experimental energy-deposition frequency distributions; measured by means of a proportional counter, were transformed to those of other pathlengths, under a compound Poisson process, and the results were compared with the corresponding experimental spectra. The computational technique, in the form of a computer program, was written by Kellerer. The input distributions were produced by ~45 MeV and 600 MeV protons passing through tissue-equivalent gas mixtures whose areal densities are on the order of 1×10^{-4} g/cm^2. For transformations which produce calculated spectra whose mean energies lie sufficiently close to those of the input spectra (shift factors of ~0.75), reliable predictions of experimental energy-deposition spectra can be made. Calculations of this type potentially could reduce considerably the experimental work which must be done to define distributions needed for the folding of such distributions into those corresponding to volumes of interest. (auth)

29358 ELEMENTAL X-RAY CROSS SECTIONS AT SELECTED WAVELENGTHS. Bracewell, B. L.; Veigele, W. J. (Kaman Sciences Corp., Colorado Springs, CO). Advan. X-Ray Anal.; 15: 352-364(1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

Revised tables of x-ray mass attenuation and absorption cross sections were prepared for the elements with atomic numbers one to 94 at selected wave-lengths of interest to spectroscopists, microprobe users, diffraction workers, etc. The tables are derived from an x-ray cross section compilation to be published during the summer of 1971. The new compilation is a revision of a previous work and provides photoelectric, coherent scattering, incoherent scattering, absorption component of incoherent scattering and total attenuation cross sections for 94 elements for the photon energy range 0.1 keV to 1 MeV (0.0124 Å to 124 Å). The cross sections for energies greater than 1 keV (12.4 Å) were determined from experimental attenuation data and theoretical scattering cross sections calculated using form factors and incoherent scattering functions based on a relativistic self-consistent field method. For hydrogen, the photoelectric absorption cross sections were calculated exactly. Least squares procedures were used to interpolate and extrapolate for elements and photon energies where no experimental data were found. Cross sections for the energy range 0.1 keV to 1 keV (12.4 Å to 124 Å) were calculated using nonrelativistic, single electron, self-consistent field theory with Herman–Skillman bound state wave-functions. A brief description is given of the assumptions and methods used in preparing the revised compilation, and estimated uncertainties in the cross section are reported. Examples illustrating agreement between tabulated values and experimental data are given and a comparison is made with values taken from earlier x-ray cross section compilations. (auth)

29359 STUDIES OF X RAYS INDUCED BY CHARGED PARTICLES. Duggan, J. L. (Oak Ridge Associated Universities, TN); Beck, W. L.; Albrecht, L.; Spaulding, J. D.; Munz, L. Advan. X-Ray Anal.; 15: 407-423(1972).

From twentieth annual conference on applications of x ray analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802.

Characteristic x rays were produced for a variety of samples by bombardment with protons in the energy range from 75 keV to 5 MeV. The experiments were performed with two accelerators. For the low-energy studies (less than 150 keV), a Cockcroft–Walton accelerator was used. The higher-energy studies were done with a 5 MV Van de Graaff. The x rays were measured with high-resolution Si(Li) and Ge(Li) detectors. Yields for the cross section of characteristic K- and L-shell ionizations were measured for titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, silver, gold, bismuth, and uranium. The experimental cross-sections have been compared to the theoretical predictions of the Born approximation for an interaction of this type. Trace element analysis by 4-MeV proton bombardment of samples in the 10^{-12} gm range was also performed. Some comments with regard to analysis with these sensitivities will be made. (auth)

29360 A TIME OF FLIGHT METHOD OF INVESTIGATING THE EMISSION OF LOW ENERGY POSITRONS FROM METAL SURFACES. Coleman, P. G.; Griffith, T. C.; Heyland, G. R. (University Coll., London). Proc. Roy. Soc. (London), Ser. A; 331: No. 1587, 561-569(16 Jan 1973).

A time-of-flight technique with a relatively weak radioactive source of positrons was used to observe the enhanced emission of positrons with energy less than 1 eV from metal surfaces. Careful design of the source assembly has resulted in an appreciably higher yield of low energy positrons than has been observed by other methods. (auth)

29361 DETERMINING THE CHARACTERISTICS OF THE RANGE OF THE FRAGMENTS FROM FISSION IN THE WORKING GAS OF A DOUBLE IONIZATION CHAMBER. Kashoukeev, N. T.; Kalinkova, N. I.; Chichkov, N. F.; Toshkov, S. A.; Aidemirski, P.; Yanminchev, V. (Inst. of Physics, Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 11, 1507-1510(1972).

A method is given for the ranges of fission fragments depending on their energy, the coefficient β from the equation $R = \beta E^{\frac{1}{2}}$, and the coefficient B from the dependence $E_\beta = E_c(1 - BE_c^{\frac{1}{2}} \cos\theta)$ where E_β is the energy of the impulse from the high voltage electrode, E_c is the summary kinetic energy of the two fragments, and θ is their angle of flying-off. (JFP)

Radiation Protection Standards

Refer also to abstracts 27778, 27792–27794, and 27888.

29362 (BRH-DEP-73-3, pp 240-253) SAFETY RECOMMENDATIONS IN ANSI DOCUMENTS. Eisenhower, E. H. (National Bureau of Standards, Washington, DC). Oct 1972.

In radiation safety and protection in industrial applications.

The distinctions between regulations, standards, and recommendations are discussed. The development of standards is described. Existing and near-future ANSI voluntary standards that relate to radiation safety in industrial applications are described. (MHR)

29363 (BRH-DEP-73-3, pp 269-281) INDUSTRIAL RADIATION PROTECTION UNDER THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT. Gundaker, W. E.; Elder, R. L. (Bureau of Radiological Health, Rockville, MD). Oct 1972.

In radiation safety and protection in industrial applications.

Activities of the Bureau of Radiological Health, Food and Drug Administration, to carry out the requirements of the Radiation Control for Health and Safety Act as it applies to industrial radiation equipment are briefly described. The provisions of the Act and the Regulations published subsequent to it are discussed, with emphasis on the radiation safety performance standards that directly affect industrial radiation protection. (CES)

29364 GUARANTEE OF RADIATION PROTECTION AND SAFETY BY WORK OF THE GENERAL CONTRACTOR FOR NUCLEAR POWER PLANTS. Krueger, F. W. (VEB Kombinat

Kraftwerksanlagenbau, Berlin). Kernenergie; 15: No. 6, 189-192(Jun 1972). (In German).

The works to be carried out by the general contractor for nuclear power plants to guarantee radiation protection and safety are briefly described. In particular, the importance which the measures to secure quality for failure-free operation of the nuclear power plants have is pointed out. By examples the possibilities to secure quality in design and erection of a nuclear power plant are shown. (auth)

Radiation Source Calibration and Standardization

Refer also to abstract 29052.

29365 COMPENSATION FILTERS FOR LEVELING OUT ISODOSES. Kozlov, V. A.; Denisenko, O. N.; Goldobenko, G. V. (Scientific-Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 18: No. 3, 60-62(Mar 1973). (In Russian).

Compensation filters for the Rokus gamma apparatus were used for the purpose of increasing the effective width of the beam and creation of uniform distribution. (auth)

29366 NEW ALPHA ENERGY STANDARDS. Rytz, A.; Grennberg, B.; Gorman, D. J. (Bureau International des Poids et Mesures, Sevres, France). pp 1-9 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From 4th international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931-.

The reasons why reliable α-energy standards are of considerable importance are listed. The evolution with time of the energy values adopted for some widely used standards are reviewed. Following a request that the best standard for some easily accessible α-emitters should be chosen it was decided that compiling and adjusting old results was not sufficient and that new absolute measurements should be undertaken. Thus, a 180° uniform-field magnetic spectrograph was constructed with emphasis on absolute energy measurements of the highest accuracy. Thirty-one new results from twenty α-emitters have been obtained. A survey of the method is given, including the magnetic field measurements, the method of length measurement, the types of sources and the line-shape calculation. Results are tabulated. (auth)

Shielding Calculations and Experiments

29367 (CONF-721018-17) APPLICATIONS OF THE TRANSMISSION MATRIX METHOD IN GAMMA RAY SHIELDING ANALYSIS. Rohach, A. F. (Iowa State Univ. of Science and Technology Ames). 1972. 14p. Dep. NTIS (U. S. Sales Only) $3.00.

From fourth international conference on reactor shielding; Paris, France (9 Oct 1972).

The transmission matrix method was applied to various gamma ray shielding problems. The transmission matrix from plane geometry analysis was used to develop a point geometry matrix kernel. The point kernel was investigated for shielding slabs of two or more materials. Various types of shielding configuration using surface sources, volumetric sources, and exponential secondary sources were also investigated. Results were compared with previous published works and other computations using scalar point kernel and buildup factor analyses. (France)

29368 (ZJE-131) REMOVAL P1 METHOD FOR CALCULATION OF RADIATION DISTRIBUTION IN SHIELDING. Valenta, V. (Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Construction Dept.). 1972. 97p. Dep. NTIS (U. S. Sales Only) $7.00.

The theoretical principles of the REMP1 program, which calculates a neutron flux distribution, and that of gamma radiation in one-dimensional geometry by the removal P1 approximation are presented. A derivation of removal cross section based on the transport corrections of higher orders is also presented. In the calculations of primary radiation distribution the S_n method and the DSN method were successfully used. Requirements are described for a general program for engineering calculations of shields, where a special stress is laid upon the correction of cross sections in dependence on temperature distribution in shielding. The results of calculations using the REMP1 program for neutron and gamma radiation are presented in the second part of this work. The results were compared with calculations using the other codes. (auth)

29369 CONTRIBUTION TO THE THEORETICAL AND EXPERIMENTAL DETERMINATION OF GAMMA-RAY ENERGY DISTRIBUTION AFTER PENETRATION THROUGH THICK ABSORBING LAYERS. Brust, R. (Deutsches Amt fuer Messwesen und Warenpruefung, Berlin). Kernenergie; 15: No. 6, 193-201(Jun 1972). (In German).

Studies of the spectral distribution of 662-keV quantum radiation after penetrating through a plane parallel absorbing plate are described, which were carried out by both theoretical and experimental techniques for large intervals of thickness (from 1 up to 10 cm) and atomic number (Z = 13 up to 82) of the medium to be penetrated. Theoretical determination of the distributions of scattered radiation was made on the basis of an approximation method for solving the transport equation given by Galishev. For experimental determination of the distribution of scattered radiation, a scintillation-spectrometric arrangement was used followed by the unfolding of the measured pulse-height distribution to the corresponding true energy spectrum of quantum radiation applying the method of response matrix inversion of the detector system. A comparison of the theoretical spectra of scattered radiation with the experimental distributions shows sufficient agreement of the curves over the whole interval of energies considered. Moreover, on the basis of the energy spectra obtained some characteristics of the distribution of scattered radiation were derived as a function of atomic number and thickness of the absorbing medium. (auth)

PHYSICS (SOLID-STATE)

Radiation Effects

Refer also to abstracts 27283 and 29027.

29370 INFLUENCE OF LIGHT ON THE ELECTRIC AND MECHANICAL PROPERTIES OF LiF. Durgaryan, A. A.; Kasparova, S. V. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 7: No. 4, 254-260(1973). (In Russian).

An investigation was made of the influence of light on the internal friction and electric resistance of LiF crystals before and after exposure to γ and x rays. Results show that illumination raises the internal friction and sharply reduces the electric resistance, the influence of γ and x ray exposure being unobserved. It was discovered that in the presence of some fresh dislocations in LiF crystals, the character of the influence of light and x and γ rays is modified. (auth)

29371 X-RAY DOUBLE-CRYSTAL-DIFFRACTOMETER INVESTIGATIONS OF IMPLANTED SILICON: D^+ AND N^+. teKaat, E. H.; Schwuttke, G. H. (IBM Corp., Hopewell Junction, NY). Advan. X-Ray Anal.; 15: 504-515(1972).

From 20th Annual Conference on Applications of X-Ray Analysis; Denver, Colorado, United States of America (USA) (11 Aug 1971).

See CONF-710802--.

Double-crystal-diffractometer measurements on silicon bombarded to a fluence $>10^{16}$ ions/cm^2 with 1-MeV deuterium and 2-MeV nitrogen are reported. Such measurements provide insight into radiation damage in silicon through the observation of Bragg-case pendelloesung fringes and double-peak rocking curves. Bragg-case pendelloesung fringes are used to determine nondestructively the projected range of ions in silicon. Double-peak rocking curves are used to measure changes in lattice parameter with the ion dose. Finally, a model of radiation damage in silicon is presented. (auth)

29372 ELECTRON IRRADIATION EFFECTS ON THIN CaF_2 FILMS. Koch, F. A.; Vook, R. W. (Syracuse Univ., NY). J. Vac. Sci. Technol.; 10: No. 1, 313-315(1973).

CaF_2 films, 30 to 1000 Å in average thickness, were formed at 25 to 380°C on {001} NaCl under ultrahigh vacuum conditions. Transmission electron diffraction and microscopy showed that these films consisted of many {110} oriented crystallites coexisting with {001} oriented crystallites. It was found that high-intensity 50-, 80-, and 100-kV electron beams in the electron microscope altered the structure of these films. The electron beams had a randomizing effect on the CaF_2 films. Extra diffraction rings were observed that could not be explained in terms of CaF_2 or double diffraction reflections. These extra rings were due to CaO. No diffraction evidence for free Ca metal was obtained. Previous work by Evans suggested that CaF_2 decomposes to form free Ca under the action of an electron beam. In the present work it is believed that electron irradiation first produces free Ca metal which then oxidizes to CaO in the relatively high oxygen partial pressure in the electron microscope. (auth)

29373 IRRADIATION OF DIAMOND CRYSTALS WITH PROTONS. Gerasimenko, N. N.; Donina, V. I.; Lezheiko, L. V.; Sirochinskii, S. E.; Smirnov, L. S. (Inst. of Semiconductor Physics, Novosibirsk, USSR). Sov. Phys.-Semicond. (Engl. Transl.); 6: No. 8, 1292-1296(Feb 1973).

Translated from Fiz. Tekh. Poluprov.; 6: No. 8, 1489-1494 (Aug 1972).

A study was made of the influence of 1.5-MeV proton irradiation and subsequent annealing at 200 to 1000°C on the electrical properties and the cathodoluminescence spectra (λ = 3500 to 6000 Å) of diamond crystals. Such irradiation produced partly compensated semiconducting n-type layers in insulating crystals and it compensated semiconducting synthetic diamonds. Several vibronic series (N_3, N_4, etc.) appeared in the cathodoluminescence spectra at certain stages of annealing. The results obtained were explained on the assumption that radiation defects gave rise to compensation and formed disordered regions. (auth)

29374 STRUCTURE OF DEFECTS IN GRAPHITES IRRADIATED AT 1000 AND 1500°C. Thrower, P. A.; Burleigh, D. D. (Pennsylvania State Univ., University Park). , pp 162-163 of Carbon 1972. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

Six pyrolytic graphites of various crystallite size and perfection were irradiated at temperatures of 1020°C and 1475°C to different doses. The crystallite perfection was examined using a surface oxidation techniques. After irradiation, the samples were examined by transmission electron microscopy. The character of the defects produced varied between samples and some correlation with structure is sought. (auth)

29375 ION-IMPLANTED SILICON PLANAR DIODES. Saczuk, K.; Kunicki, J.; Krylow, J. Elektronika; No. 12, 494-496(1972). (In Polish).

For the fabrication of diodes, wafers of n-type silicon with epitaxial layers were used. The surfaces were oxidized to 6000 Å and windows were made by photolitography. Boron was then implanted and after that samples were heated in N atmosphere to anneal radiation damage and electrical activation of boron atoms. The I–V and C–V characteristics were measured as well as resistance R_s. (In Polish)

29376 TROMBAY ION IMPLANTATION FACILITY AND SOME RESULTS ON IMPLANTATION OF Xe^+, Kr^+, AND N^+ IONS. Sood, D. K.; Thampi, N. S.; Sarma, N. (Bhabha Atomic Research Centre, Bombay). pp 479-488 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

Physical Properties

Refer also to abstract 29003.

29377 (JUL-CONF-6(VOL.1)) INTERNATIONAL MEETING ON HYDROGEN IN METALS, KERNFORSCHUNGSANLAGE, JUELICH, GERMANY, MARCH 20-24, 1972. (Deutsche Bunsengesellschaft fuer Physikalische Chemie E. V., Frankfurt am Main (West Germany); Kernforschungsanlage, Juelich (West Germany). Institut fuer Festkoerperforschung). Mar 1972. 400p. (CONF-720326–(Vol.1)).

Twenty-eight papers and abstracts of review papers arranged into two sections dealing with thermodynamics and structure and NMR and neutron scattering are included. Separate abstracts were prepared for 14 of the papers; one of the remaining papers was previously abstracted as NSA 26: 30125. (DLC)

For abstracts of individual papers see: 28112–28116 and 29378–29386.

29378 (JUL-CONF-6(VOL.1), pp 23-36) ANALYSIS OF THE THERMODYNAMIC BEHAVIOR OF HYDROGEN IN bcc METALS WITH APPLICATION TO NIOBIUM–HYDROGEN. O'Keeffe, M.; Steward, S. A. (Arizona State Univ., Tempe). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

A critical analysis of experimental data for the Nb–H system shows that the partial molar entropy data are best interpreted by assuming a random solution of hydrogen in the metal on one site per metal atom even in concentrated solutions. A possible geometrical interpretation of this result is suggested. (auth)

29379 (JUL-CONF-6(VOL.1), pp 118-143) DETERMINATION OF INTERSTITIAL DEUTERIUM LOCATIONS IN NIOBIUM BY CHANNELING. Carstanjen, H. D. (New York Univ., NY). Sizmann, R. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The D(d,p)T reaction yield was measured around the ⟨100⟩ and the ⟨111⟩ incidence directions of a 300-keV deuteron beam penetrating through niobium monocrystals loaded with 2 at. % deuterium. In combination with flux and energy distribution calculations of the channeled deuterons, the conclusion was reached that, at 150°K, the dissolved deuterium atoms are located at tetrahedral lattice sites. (auth)

29380 (JUL-CONF-6(VOL.1), pp 144-159) SOME PARTICULAR ASPECTS OF THE α PHASE OF THE LUTETIUM–HYDROGEN (OR DEUTERIUM) SYSTEM. Daou, J. N.; Bonnet, J. E. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

An electric conductivity and a crystal structure study was made of the Lu–H and Lu–D systems at temperatures up to 500°C. In the α phase beyond 380°C, H or D distributes among the tetrahedral interstices, while in the α^* phase below 170°C, H or D goes to the octahedral interstices. Lattice expansion is isotropic for the α phase and anisotropic for the α^* phase. An interstitial

atom in α phase diffuses through an octahedral interstice on its way from a tetrahedral to another tetrahedral interstice, while in the α^* phase, it makes way directly from one octahedral interstice to the neighboring one. 7 figures. (DLC)

29381 (JUL-CONF-6(VOL.1), pp 173-190) STATISTICAL MECHANICS OF A THREE-COMPONENT SYSTEM: Pd-B-H. Mehlmann, R.; Husemann, H.; Brodowsky, H. (Univ., Muenster, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The mixing model proposed for the binary systems Pd-H and Pd-B (solute atoms occupy octahedral sites, they donate valence electrons to Pd's 4d and 5s bands, and interstitial particles attract each other) is extended to the ternary system Pd-B-H. A third parameter, the energy of attraction between unlike particles, appears. Good agreement with H absorption measurements in Pd-B alloys and with magnetic susceptibility measurements is obtained. An interpretation is given for the three attraction energies in terms of a lowering of the lattice strain energy for nearest neighbor interstitial atoms. 26 references. (auth)

29382 (JUL-CONF-6(VOL.1), pp 194-204) DIFFUSE NEUTRON SCATTERING EXPERIMENTS ON THE SYSTEM NbD_x. Conrad, H.; Bauer, G. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The total intensity per scattering atom for diffuse neutron scattering, $d\sigma(\vec{K})/d\Omega$, on deuterium dissolved in niobium single crystals was measured in the α phase for three different concentrations, and at various temperatures, as a function of the scattering vector $\vec{K}$. In particular the value of $d\sigma/d\Omega$ for $\vec{K} \to 0$ was determined. For the scattering on deuterium atoms without any mutual interaction, this quantity should not depend on concentration c and temperature T. Experiments show a small but significant temperature dependence which has been fitted to a law of the form $1/(T - T_c)$. The measurements gave an anisotropy of the interaction energy $u = kT_c/c$, which varies from about 35 meV to 85 meV. This is much smaller than the value obtained by Schaumann et al. from the investigation of relaxation due to long-range diffusion; the latter experiments gave u = 210 meV. This value corresponds to density fluctuations with wavelength comparable to the sample size whereas the neutron experiments are sensitive to density fluctuations having a wavelength of the order of 3 Å and below. In the latter case, the interaction energy is reduced due to the coherency strains built up by the density fluctuations. The consequence of these results on the position of the stability curve of the lattice gas-liquid system is discussed and the absence of critical neutron scattering is predicted from the fact that the stability curve for microscopic, i.e., coherent fluctuations, lies completely within the miscibility gap. (auth)

29383 (JUL-CONF-6(VOL.1), pp 286-300) INVESTIGATION OF THE JUMP RATE OF PROTONS IN β-NbH BY MEANS OF HIGH-RESOLUTION QUASI-ELASTIC NEUTRON SCATTERING AND NMR. Alefeld, B.; Bohn, H. G.; Stump, N. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

So far, all quasi-elastic neutron studies on metal-hydrogen systems were constrained to temperatures where the jump rate of the protons is higher than 10^{11} s^{-1}. Using a backscattering spectrometer (resolution half width 9×10^{-7} eV), it was possible to measure diffusion constants and jump rates which are 10^{-7} cm^2/sec or 10^8 sec^{-1}, respectively. Such measurements are of particular interest because one gets an overlap of NMR and neutron experiments. By means of spin-lattice relaxation and quasi-elastic neutron scattering measurements, the jump rate of protons was determined in the β phase for $NbH_{0.3}$ and $NbH_{0.9}$ between -70°C and 70°C. Good agreement between the results of the two techniques was obtained. Below 40°C, the jump rate follows an Arrhenius law $1/\tau = \nu_0 \exp E_{act}/k_BT$ with $\nu_0 = 1 \times 10^{12}$ s^{-1} and $E_{act} = 0.22$ eV. From the neutron data, the jump distance was estimated to be 4.8 ± 0.8 Å. (auth)

29384 (JUL-CONF-6(VOL.1), pp 301-312) STUDY OF HYDROGEN DIFFUSION IN VANADIUM AND TANTALUM HYDRIDE BY QUASI-ELASTIC THERMAL-NEUTRON SCATTERING. de Graaf, L. A. (National Bureau of Standards, Washington, D. C.). Rush, J. J.; Livingston, R. C.; Flotow, H. E.; Rowe, J. M. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Neutron line widths associated with diffusion broadening were determined at 485°K for $VH_{0.198}$ and $VH_{0.570}$ and at temperatures between 295 and 613°K for $TaH_{0.15}$. These measurements cover a range of momentum transfers (Q) for elastic scattering up to 4.1 $Å^{-1}$. This is much larger than the momentum transfers obtained in earlier cold-neutron experiments. The line width results for α-$VH_{0.570}$ are compared with models, especially with a model allowing occupation of multiple sites. This comparison leads to the conclusion that jumps between tetrahedral sites seem to be predominant in the diffusion process. Differences in the line width behavior for $VH_{0.20}$ and $VH_{0.57}$, and the fact that the measured widths at large Q increase rapidly with Q rather than approaching an asymptotic value as predicted by the theory, are discussed. The tantalum hydride width curves are compared to the VH_x results and to the same models. It is suggested that the observed line width behavior and the large Debye-Waller factors found for VH_x are connected with the relative magnitudes of diffusion relaxation time and the jump time between sites. (GF)

29385 (JUL-CONF-6(VOL.1), pp 313-345) NEUTRON SCATTERING STUDY OF HYDROGEN MOTIONS IN NIOBIUM. Birchall, J. H. L.; Ross, D. K. (Univ. of Birmingham, Eng.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The vibrational and diffusive behavior of H in polycrystalline and monocrystalline α-NbH (H = 0.14, 0.08, 0.013) was investigated gated in the temperature range 130 to 400°C by means of coherent and quasi-elastic cold neutron scattering. The main feature of the inelastic spectra in the acoustic region is the broadening of the acoustic modes in the metal and the appearance of a similar amplitude weighted frequency distribution of the dissolved H. The conclusions from the optical modes are similar. Optical modes are so damped as to be unobservable, but the width of the optical peak can nevertheless be partly attributed to H-H interactions although mixing with the acoustic modes may also be important. The decrease in the broadening with reduced H concentration can be attributed to the H-H interaction, while the increase in width with increasing temperature will be due to increased mixing of the different kinds of motion. (GF)

29386 (JUL-CONF-6(VOL.1), pp 375-387) QUASI-ELASTIC NEUTRON SCATTERING ON HYDROGEN IN NIOBIUM SINGLE CRYSTALS. Stump, N. (Institut fuer Festkoerperforschung, Juelich, Ger.); Gissler, W.; Rubin, R. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Experiments on the system $NbH_{0.07}$ were performed at 235 and 256°C. For studying the anisotropy, the half width of the quasi-elastic line dependent on the crystal orientation was measured for fixed momentum transfer vectors and on the momentum transfer vector being parallel to the investigated symmetry direction. Results were compared with theoretical half widths corrected for experimental resolution. They exclude the octahedral and cubic interstitial site model, assuming simple jump diffusion. In two of the main symmetry directions the agreement with the simple tetrahedral model is fairly good, but in the third there are strong deviations. (GF)

29387 (JUL-CONF-6(VOL.2)) INTERNATIONAL MEETING ON HYDROGEN IN METALS, KERNFORSCHUNGSANLAGE, JUELICH, GERMANY, MARCH 20-24, 1972. (Deutsche Bunsengesellschaft fuer Physikalische Chemie E. V., Frankfurt am Main (West Germany); Kernforschungsanlage, Juelich (West Germany). Institut fuer Festkoerperforschung). Mar 1972. 501p. (CONF-720326-(Vol.2)).

A total of 45 papers and abstracts of summary lectures is presented on diffusion and electronic properties. Separate abstracts were prepared for 15 of the papers. (DLC)

For abstracts of individual papers see: 28857, 29388-29400, and 29413.

29388 JUL-CONF-6(VOL.2), pp 391-399) TRITIUM DIFFUSION IN TRANSITION METALS. Buchold, H.; Sicking, G. (Institut fuer Physikalische Chemie, Muenster, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The diffusion coefficient of T in Pd, Pd-Ag, and Pd-B alloys was measured in the temperature range 0 to 50°C. The results are compared with those obtained for H and D. (GF)

29389 (JUL-CONF-6(VOL.2), pp 409-416) DIFFUSION ISOTOPE EFFECTS IN ISOTOPE MIXTURES. Bonn, B.; Gans, E.; Sicking, G.; Wicke, E. (Institut fuer Physikalische Chemie, Muenster, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Results of D and T tracer diffusion in the β phase of PdH_n are compared with those of the "pure" systems Pd/H, Pd/D, and Pd/T. It is shown that the mobility of D in the surroundings of H in PdH_n is smaller than in PdD_n, whereas T seems to have a higher mobility in PdH_n as compared to PdT_n. The mechanism of the diffusion transport is discussed on the basis of the results which are considered as first approximations only. (GF)

29390 (JUL-CONF-6(VOL.2), pp 418-434) ISOTHERMAL HYDROGEN DIFFUSION IN ZIRCALOY–YTTRIUM COMBINATIONS. Frisius, F.; Lahann, H. J.; Mertins, H.; Spalthoff, W.; Wille, P. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Insertion of yttrium in Zircaloy (hydrogen getter) for application in reactor technology prevents hydrogen embrittlement. Therefore, hydrogen diffusion in a welded combination of the two metals with different affinities for hydrogen is investigated both experimentally and theoretically under simplified conditions as slab-diffusion, no thermal diffusion, and solid solution of hydrogen in the α phase of Zy-2 and Y. Hydrogen concentrations were determined by thermal-neutron scattering. (GF)

29391 (JUL-CONF-6(VOL.2), pp 437-448) DETERMINATION OF DIFFUSION COEFFICIENT AND HEAT OF TRANSPORT FOR H AND D IN NIOBIUM BY RESISTIVITY MEASUREMENTS. Wipf, H. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

In foil-shaped samples, homogeneously loaded with H or D ($0.01 < c < 0.15$ at. %), a temperature gradient was produced. The redistribution of H under the thermal gradient or after turning off the thermal gradient could be followed by resistivity measurements. For the diffusion coefficient of D, an activation energy of (0.123 ± 0.006) eV was found in the temperature range investigated (150 to 320°K). In contrast to D, a pronounced break in the Arrhenius plot occurs for H at about 225°K. The activation energy changes from (0.093 ± 0.009) eV for $T > 225$°K to (0.061 ± 0.006) eV for $150\text{°K} < T < 225\text{°K}$. The ratio between the diffusion coefficients for H and D changes from 2 at room temperature to about 15 for 150°K. For the temperature between 200 and 300°K, the heats of transport amount to (0.13 ± 0.02) eV for H and (0.14 ± 0.02) eV for D. (GF)

29392 (JUL-CONF-6(VOL.2), pp 544-556) ABSENCE OF THE SNOEK EFFECT FOR HYDROGEN IN TANTALUM. Buchholz, J. (Institut fuer Festkoerperforschung, Juelich, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The temperature dependence of the elastic coefficients of Ta single crystals loaded with different concentrations of hydrogen (3 to 11 at. %) was measured in the temperature range between 295 to 459°K in a torsion pendulum (frequency about 15 Hz). A para-elastic contribution due to the Snoek effect of the dissolved hydrogen is expected. Whereas the lattice expansion of hydrogen is only a factor of three smaller than for instance for nitrogen, the Snoek effect contribution of hydrogen is unobservable for the investigated concentrations. Using the experimental accuracy, the Snoek effect of H is at least two orders of magnitude smaller than for N. (GF)

29393 (JUL-CONF-6(VOL.2), pp 558-600) EFFECTS OF HYDROGEN AND OTHER INTERSTITIALS ON THE LOW-TEMPERATURE RELAXATION OF DEFORMED VANADIUM. Chang, H. Y.; Wert, C. A. (Univ. of Illinois, Urbana). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The effects of deformation on the α relaxation peak are discussed. An investigation was made of the role of mobile hydrogen and the immobile interstitials oxygen and nitrogen in the α peak in V. Deformation of the doped V wires was done by swaging, and internal friction measurements were made. O and N suppressed the α peak, while H causes growth of the peak, which saturates at 1500 ppM. Effects of strain aging, deformation, and hydride precipitation on the α peak were also studied. Four schematic relaxation models are discussed, and the activation energy of each is shown to be crucial. The differences between the α peak, the hydrogen cold work peaks, and hydride precipitation peak are elucidated. A comparison is made between the α peak and the Bordoni peak in deformed fcc metals. 16 figures, 43 references. (DLC)

29394 (JUL-CONF-6(VOL.2), pp 612-625) EXPLANATION FOR THE α-PEAK IN HYDROGENATED NIOBIUM. Buck, O. (North American Rockwell Science Center, Thousand Oaks, CA); Thompson, D. O.; Wert, C. A. Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The growth of an α peak generated by hydride precipitates in Nb can be interpreted semiquantitatively as a Bordoni peak. This means that thermally generated kinks on punched-out dislocations give rise to the loss mechanism. The temperature shift of this peak is interpreted to be due to an increase of the dislocation loop length as the precipitates grow. The present results yield reasonable values for the density and loop lengths of punched-out dislocations. (27 references) (GF)

29395 (JUL-CONF-6(VOL.2), pp 665-676) EMPIRICALLY DERIVED BAND DIAGRAMS FOR GROUP IIIb HYDRIDES. Bos, W. G. (Univ. of Louisville, Ky.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Evidence indicates that the hydrogen in Group IIIb hydrides is hydridic, rather than protonic or metallic. Bonding in these hydrides is discussed, and schematic band diagrams are derived from experimental evidence. Results are in good agreement with Switendick's augmented plane-wave calculations. (DLC)

29396 (JUL-CONF-6(VOL.2), pp 679-692) THERMODYNAMIC AND MAGNETIC PROPERTIES OF RCo_5 HYDRIDES. Kuijpers, F. A. (Philips Research Labs., Eindhoven, Netherlands). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The intermetallic compounds RCo_5 (R = La, Pr, Nd, Sm, Gd) form ferromagnetic hydrides by absorbing up to 4.5 hydrogen atoms per formula unit. Room-temperature isotherms were measured. These isotherms show two-phase regions. A neutron-diffraction study showed the hydrogen positions in the lattice of the β(I)-phase to be ($\frac{1}{4}$ $\frac{1}{4}$ O) and (x O $\frac{1}{2}$). The magnetization of the RCo_5 compounds is influenced by the absorption of hydrogen. The Co moments become smaller and the coupling of the R moments to the Co moments is weakened. In all cases, except $GdCo_5$, this leads to a decrease of the magnetization. The absorption of hydrogen by $PrCo_5$ and $NdCo_5$ decreases the temperature at which the easy direction of the magnetization leaves the c-axis. (GF)

29397 (JUL-CONF-6(VOL.2), pp 710-726) LOW-TEMPERATURE SPECIFIC HEATS OF THE DIHYDRIDES OF THE LIGHT RARE EARTH METALS. Bieganski, Z. (Inst. for Low Temperature and Structure Research, Wroclaw). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The specific heats of $LaH_{2.00}$, $LaH_{2.03}$, $CeH_{2.00}$, $PrH_{2.00}$, and $NdH_{2.00}$ were measured in the temperature range 20 to 345°K by adiabatic calorimetry. Results are compared with two possible level schemes predicted for protonic and hydridic models. (71 references.) (GF)

29398 (JUL-CONF-6(VOL.2), pp 744-753) QUANTUM INTERPRETATION OF H DIFFUSION IN Nb, Pd, Ti, AND Ni. Sussman, J. A.; Weissman, Y. (Soreq Nuclear Research Centre, Yavne, Israel). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The Arrhenius plot of the H and D diffusion in Nb and Ni consists of two straight lines instead of a single one. Furthermore, the isotope effects of Nb, Ti, and Pd are difficult to reconcile with classical theory. This set of data is interpreted in the framework of the quantum mechanical theory of diffusion. Jumping processes with intermediate excited states in several bands, having the nature of a time-dependent wave packet, are shown to explain the measured data. (22 references) (auth) (GF)

29399 (JUL-CONF-6(VOL.2), pp 770-781) DEUTERIUM DIFFUSION IN TANTALUM FROM INTERNAL FRICTION MEASUREMENTS (GORSKY EFFECT). Cantelli, R.; Mazzolai, F. M.; Nuovo, M. (Consiglio Nazionale delle Ricerche, Rome). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The long-range diffusion of deuterium in tantalum was investigated, as a function of temperature, by means of the inelastic process due to the redistribution of deuterium impurities between compressed and dilated regions of the sample, under an applied alternating stress of about 4 Hz. The diffusion coefficient was found to obey an Arrhenius-type law in the temperature range 210–390°K; a deviation was observed at lower temperature. The diffusion parameters in the exponential region are $D = (3.3 \pm 1.5) \times 10^{-4}$ cm^2/s and $W = (0.176 \pm 0.008)$ eV. (auth) (GF)

29400 (JUL-CONF-6(VOL.2), pp 782-807) INTERNAL FRICTION STUDY OF THE VANADIUM–DEUTERIUM SYSTEM. Cannelli, G.; Mazzolai, F. M. (Consiglio Nazionale delle Ricerche, Rome). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

The internal friction of deuterium-doped vanadium samples was investigated in the temperature range of 65 to 350°K. As for low deuterium concentrations (<0.18 at. %), one single relaxation effect was found near 90°K, its activation energy being 0.17

eV, and its limit relaxation time being 2×10^{-12} s. Another internal friction peak, the "precipitation peak", is found in samples with a higher deuterium concentration, with the temperatures increasing with deuterium content. The phase diagram at low temperatures was deduced by correlating the position of the "precipitation peak" with the deuterium concentration. The authors discuss the possible mechanisms of these two phenomena. (23 references, 11 figures) (GF)

29401 GRAIN BOUNDARIES AND INTERFACES. Proceedings of the International Conference, Yorktown Heights, New York, August 23–25, 1971. Chaudhari, P.; Matthews, J. W. (eds.) Surface Sci.; 31: 1-622(Jun 1972). (CONF-710830-).

From International conference on the structure and properties of grain boundaries and interfaces; Yorktown Heights, New York, USA (23 Aug 1971).

A total of 27 papers are included. Some of the topics covered are: models, dislocation cells and networks, grain-boundary behavior (dislocation, structure, energy, migration, defects, sliding, diffusional creep), epitaxial islands, and electron microscopy and diffraction. Author and subject indexes are included. (DLC)

29402 HEAT CAPACITY OF VO_2 SINGLE CRYSTALS. Chandrashekhar, G. V.; Barros, H. L. C.; Honig, J. M. (Purdue Univ., Lafayette, IN). Mater. Res. Bull.; 8: No. 4, 369-374(Apr 1973).

The heat capacity of VO_2 was remeasured both above and below the transition temperature range of 330 to 345°K. For $150 < T < 320$°K, the results could be fit to the standard Debye theory with a Debye temperature $\theta_D = 750$°K; for $360 < T < 720$°K, no Debye temperature could be assigned to the data, which exceeded the equipartition value for C_v above 580°K. The enthalpy of transition was found to be 1.12 kcal/mole VO_2. (auth)

29403 USE OF ION BEAMS IN SURFACE PHYSICS STUDIES. Carter, G. (Univ. of Salford, Eng.). J. Vac. Sci. Technol.; 10: No. 1, 95-99(1973).

A review is given of recent progress on the applications of the reflection of ions, the emission of rays by ion bombardment, and the generation of secondary ion species at solid surfaces, for composition and structure analysis. The resolution and sensitivity of the techniques are discussed and the problems of rendering the processes quantitative examined. (36 references) (auth)

29404 SOFT-X-RAY APPEARANCE POTENTIAL SPECTROSCOPY OF CARBON SURFACES. Bradshaw, A. M.; Menzel, D. (Technische Univ., Munich). pp 101-102 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden-Baden, Ger. (25 Jun 1972).

The recently developed technique of soft-x-ray appearance potential spectroscopy was applied to pyrolytic graphite and other carbon samples. The presence of prominent satellites in the pyrolytic graphite spectrum indicates that the threshold excitation is accompanied by strong plasmon excitation. The size and shape of the peak arising from the core hole excitation alone are little altered in an ungraphitized carbon. (auth)

29405 PRESENT UNDERSTANDING OF THE THERMAL PROPERTIES OF GRAPHITE. Kelly, B. T. (United Kingdom Atomic Energy Authority, Springfields, Eng.). pp 103-107 of Carbon '72. Bad Honnef, Ger.; Deutsche Keramische Gesellschaft eV (1972).

From international carbon conference; Baden–Baden, Ger. (25 Jun 1972).

The thermal properties of a solid are a measure of the interatomic forces in the crystal lattice. The semi-continuum model of the lattice dynamics of graphite developed by Komatsu was applied to the specific heat at low temperatures, principal thermal conductivities, and expansion coefficients of a graphite crystal and atomic thermal vibration amplitudes, in each case yielding good agreement with experiment and giving information on the interatomic forces. This paper summarizes the present understanding of the thermal properties and the lattice forces in graphite. (auth)

29406 CRYSTALLOGRAPHIC, MAGNETIC, AND EPR STUDIES OF RARE-EARTH AND YTTRIUM–COBALT LAVES PHASES. Burzo, E. (Inst. of Atomic Physics, Bucharest). Int. J. Magn.; 3: No. 1-3, 161-170(Sep 1972).

The structural and magnetic behavior of RCo_2 (R = Nd, Pr, Sm, Gd, Tb, Dy, Ho, Er) and YCo_2 intermetallic compounds is studied. The magnetic moments of Co and R atoms are coupled antiparallel for R = Gd, Tb, Dy, Ho, Er, while for R = Pr, Nd, and Sm this coupling is ferromagnetic. The temperature dependence of the spontaneous magnetization shows that some compounds present first-order transitions. The reciprocal susceptibility for the ferrimagnetic compounds exhibits a temperature dependence in agreement with Neel's law. The Curie constants determined experimentally were corrected because of the thermal variation of the molecular field coefficients. The γ values are estimated from pressure studies. The effective moment of cobalt atoms for these compounds is $\mu_{eff} = 2.00 \pm 0.50\ \mu_B$. The thermal variation of reciprocal susceptibility for $PrCo_2$ and $NdCo_2$ may be interpreted considering in addition to Neel's law a paramagnetic term p independent of temperature. The magnetic behavior of cobalt atoms is discussed. The results of the electron paramagnetic resonance measurements are correlated with the magnetic data. (auth)

29407 CRYSTALLOGRAPHIC, MAGNETIC, AND EPR STUDIES OF RARE-EARTH AND YTTRIUM–NICKEL LAVES PHASES. Burzo, E. (Inst. of Atomic Physics, Bucharest); Laforest, J. Int. J. Magn.; 3: No. 1-3, 171-177(Sep 1972).

Magnetic measurements on the RNi_2 intermetallic compounds (R = Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, and Tm) and YNi_2 have been performed at 4.2 to 700°K. YNi_2 presents Pauli paramagnetism, while RNi_2 are ferromagnetic. In these systems, nickel has no magnetic moment, its configuration being probably $3d^{10}$. Above the Curie temperature the reciprocal susceptibility follows a Curie-Weiss behavior, except for $SmNi_2$. The paramagnetic moments of these compounds coincide with those of rare-earth ions. For $SmNi_2$, if taking into account both the exchange and Van Vleck-type paramagnetism, the best agreement with the experimental data is obtained for a spin orbit coupling constant $k_3 = 384$°K and an exchange parameter $J_f k_B = 8$°K. The electron paramagnetic resonance measurements which have been carried out on Gd Ni_2 lead to $g_s = 1.980$ and DH T = 2.45 Gs°K. The exchange integral $J_{sf} = -0.022$ eV. $F(2k_F R_n)$ has been calculated and, in agreement with T_p, a reduction of the Fermi wave vector comparatively to free electron model is observed. (auth)

29408 MAGNETIC PROPERTIES AND ELECTRONIC STRUCTURE OF RARE-EARTH–TRANSITION METAL INTERMETALLIC COMPOUNDS. Gomes, A. A.; Guimaraes, A. P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 19: No. 7, 195-227(1972).

A model for the electronic structure of the $R_x M_y$ intermetallic compounds is proposed in which the s electrons are spread over the crystal and the d states are localized on the transition metal sites. Two cases are considered including 1) magnetism driven by the localized f moments (e.g. $GdCo_2$), and 2) magnetism sustained by the d band (e.g. $LuFe_2$). These two situations are discussed in terms of an effective s–d coupling and an s–f exchange; the transition metal magnetic moment in case 2) is calculated using a simple model. The rare-earth hyperfine fields and isomer shifts, as well as the total paramagnetic susceptibility of the compound are also considered. Finally, the effects of V_{sd} hybridization are studied, as they provide a mechanism for the effective s–d coupling. (auth)

29409 NEUTRON-DIFFRACTION STUDIES IN THE SYSTEM $ErAl_3$–$ErAl_2$. Will, G.; Bargouth, M. O. (Univ., Bonn). Int. J. Magn.; 3: No. 1-3, 87-92(Sep 1972).

In the binary system Er–Al, crystals of composition $ErAl_2$, $Er_xY_{1-x}Al_2$, and $ErAl_3$ were studied by neutron diffraction and their magnetic structures determined. In $ErAl_3$ two polymorphs, hexagonal and cubic were investigated. Crystal-field effects are large in these crystals and antiferromagnetic ordering is observed in both polymorphs below $T_N = 5.1$°K. The magnetic moment values are, respectively, 6.6 μ_B and 5.1° μ_B, much below the free ion value. $ErAl_2$ and its diluted members $Er_xY_{1-x}Al_2$ exhibit ferromagnetic ordering until an erbium concentration of about 30%. In all crystals a moment of 8.8 to 9.0 μ_B is observed, which corresponds to the expected full moment for the free ion. (auth)

29410 STRUCTURE OF Ta_2D. Petrunin, V. F.; Khvatinskaya, D. Ya. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 4, 74-75(1972). (In Russian).

The intensity of neutron-diffraction peaks of Ta_2D was studied at room temperature and at liquid nitrogen. Calculations using a formula of Petrunin (Kristallografiya, No. 1; 15(1970)) confirmed previous conclusions that the structure of the ordered phase is related to the space group C222. (KSW)

29411 HYPERFINE MAGNETIC FIELDS AT As IN Fe, Co, AND Ni. Chopra, R. C.; Tandon, P. N. (Tata Inst. of Fundamental Research, Bombay). pp 357-361 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29412 INTERNAL HYPERFINE FIELDS ON ARSENIC IN COBALT AND NICKEL HOSTS. Dhar, A. K.; Singh, B.; Singh, V.; Hans, H. S. (Panjab Univ., Chandigarh, India). pp 363-367 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

Moessbauer Effects and NMR

Refer also to abstracts 27681 and 28116.

29413 (JUL-CONF-6(VOL.2), pp 727-733) MOESSBAUER SPECTROSCOPY IN Nb-(^{57}Fe)-H. Ableiter, M.; Gonser, U. (Univ. Saarlandes, Saarbruecken, Ger.). Mar 1972.

From International meeting on hydrogen in metals; Juelich, Germany (20 Mar 1972).

Preliminary results are reported of studies by which a filling of the rather-empty d band in Nb with increasing H concentration (15 at. % H) could not be detected; instead, various lines appeared indicating different "phases". (GF)

29414 MONTE CARLO METHOD FOR FITTING ^{57}Fe MOESSBAUER SPECTRA. Davidson, G. R. (Bell Telephone Labs., Murray Hill, NJ). Nucl. Instrum. Methods; 107: No. 3, 557-561 (1973).

A convenient, systematic, and inexpensive procedure for determining values for the hyperfine parameters H_{hf}, ΔE_Q, η, θ, and φ consistent with a ^{57}Fe Moessbauer spectrum is described. Only line position information is used in this procedure. H_{hf} and $|\Delta E_Q|$ are determined analytically, while values for the remaining parameters are found by use of a Fortran IV Monte Carlo search program. (auth)

29415 NUMERICAL ANALYSIS OF MOESSBAUER SPECTRA: CORRECTION FOR THICK ABSORBERS. Stone, A. J. (Cambridge Univ., Eng.). Nucl. Instrum. Methods; 107: No. 2, 285-291(1973).

Analytical equations are given for the parameters of a least-squared Lorentzian fitted to the Moessbauer spectrum for a thick absorber, in terms of the parameters of the absorber. The equations have been solved by computer and a correction table is given for determining the absorber parameters from those of the fitted curve. The correction required is substantial, even for absorbers commonly regarded as "thin," and the results throw serious doubt on quantitative work based on uncorrected intensity measurements. (auth)

29416 ANALYTIC METHOD FOR THE LEAST-SQUARES FITTING OF SINGLE-LINE THICK-ABSORBER MOESSBAUER SPECTRA. Cleveland, B. T. (State Univ. of New York, Buffalo). Nucl. Instrum. Methods; 107: No. 2, 253-257(1973).

A method is presented which expresses the integral for the Moessbauer thick-absorber line shape as a rapidly converging series. This method also permits calculation of the first derivatives of the absorption function so that the line-shape integral can easily be used for the least-squares fitting of experimental spectra. The use of this procedure for the measurement of Moessbauer parameters is discussed. In the interest of rapid computation, this procedure is entirely analytic; numerical integration and differentiation are avoided. (auth)

29417 DETERMINATION OF HYPERFINE INTERACTION PARAMETERS FROM UNRESOLVED MOESSBAUER SPECTRA. Hembree, G.; Price, D. C. (Univ. of Manitoba, Winnipeg). Nucl. Instrum. Methods; 108: No. 1, 99-106(1973).

The necessity of accounting for sample thickness in fitting Moessbauer spectra that consist of two overlapping peaks has recently been emphasized by Meads et al. and Winder and Hershkowitz (Nucl. Instr. Methods, 98: 29 and 105(1972)). Here, it is shown that, for the case of $^{119}SnO_2$, that direct fitting of the Moessbauer transmission integral to the experimental spectra can be an economical and convenient way of determining both the nature of a broadened but unresolved Moessbauer spectrum and the value(s) of the hyperfine interaction parameter(s). The method is also extended to the accurate determination of hyperfine parameters in magnetically split spectra. This is done using a procedure analogous to that employed in the case of two-peak spectra, and the magnetic hyperfine field at ^{119}Sn dissolved in nickel was found to be 18.08 ± 0.02 kOe at room temperature. Application of this technique to studies of the critical behavior of the hyperfine field is pointed out. Values of the recoil-free fraction in both source and absorber can also be obtained. It was determined that for $^{119}SnO_2$ at room temperature, $f_a = 0.28 \pm 0.03$ and this was reconciled with previously reported higher estimates of this quantity in terms of the assumed value of the internal conversion coefficient in $^{119}Sn^m$. Values of f_a for ^{119}SnNi and f_a for Ba $^{119}Sn^m O_3$ were also determined but their reliability is doubtful. (25 references) (auth)

PHYSICS (THEORETICAL)

Refer also to abstracts 29052, 29176, and 29179.

29418 PAULI LECTURES ON PHYSICS. Volume 5. Wave Mechanics. Pauli, W. Cambridge, MA; The MIT Press (1973). 218p. $9.95.

Translated by H. R. Lewis and S. Margulies.

The topics covered are wave functions of force-free particles, the description of a particle in a box and in free space, a particle in a field of force, more than one particle, and eigenvalue problems and functions of mathematical physics. Also collision processes, approximate methods for solving the wave equation, matrices and operators in perturbation theory, angular momentum and spin, and identical particles with spin are treated. (JFP)

29419 VON NEUMANN ALGEBRAS OF OBSERVABLES WITH THE NONABELIAN COMMUTANT AND SUPERSELECTION RULES. Kharatyan, S. G. (Inst. of Physics, Erevan). Teor. Mat. Fiz.; 14: No. 3, 306-313(Mar 1973). (In Russian).

The representations of the observable algebra in the Hilbert space $\mathcal{H}$ are considered, in which every vector functional can be weakly approximated by finite convex linear combinations of pure states. It is proved that this assumption is equivalent to the property that $\mathcal{H}$ is the closure of the linear hull of the set of vectors representing pure states. The general definition of superselection rules is introduced, and it is proved that the set of superselection operators coincides with the set of all self-adjoint operators affiliated to the center of the von Neumann algebra of observables. A number of properties of coherent subspaces is considered. (auth)

29420 COMPLETE SET OF QUANTUM MECHANICAL OBSERVABLES ON TWO-DIMENSIONAL SPHERE. Lukach, I. (Physical Inst., Bratislava). Teor. Mat. Fiz.; 14: No. 3, 366-380(Mar 1973). (In Russian).

The problem of diagonal operators on two-dimensional sphere is considered. Trigonometical form of the elliptic coordinate system on the sphere, convenient for physical applications, is given. Wave eigenfunctions of the diagonal operators in the elliptic coordinate system (the so-called sphero-conical functions) are constructed, and their principal properties are pointed out. The equations are deduced, which determine the eigenvalues of the second diagonal operator in the elliptic coordinate system. Some matrix elements of sphero-conical functions are calculated. Possibilities of physical applications of the complete set of quantum mechanical observables connected with the elliptic coordinate system on two-dimensional sphere are discussed. (auth)

29421 POSTULATIONAL FRAMEWORK FOR THEORIES OF SIMULTANEOUS MEASUREMENT OF SEVERAL OBSERVABLES. Prugovecki, E. (Univ. of Toronto). Found. Phys.; 3: No. 1, 3-18 (Mar 1973).

A reproducibility principle is formulated and adopted as the guiding criterion for the acceptance of an experimental procedure as a simultaneous measurement of several observables. It is pointed out that this criterion can be applied to classical as well as quantum physics, and that it incorporates compatible as well as incompatible observables. The concept of fuzzy probability measure is presented as a possible mathematical tool for the description of statistical processes involving measurements of incompatible observables. (auth)

29422 PHYSICS AND THE SEMANTICS OF QUANTUM MEASUREMENT. Margenau, H. (Yale Univ., New Haven); Park, J. L. Found. Phys.; 3: No. 1, 19-28(Mar 1973).

In a recent paper, Prugovečki offered a theory of simultaneous measurements based upon an axiomatic description of the measurement act which excludes certain illustrations of simultaneous measurement previously discussed by the present writers. In this article, the fundamental conceptions of state preparation, state determination, and measurement which underlie our research are compared to Prugovečki's interpretations of the analogous constructs in his theory of measurement. (auth)

29423 POSSIBILITY OF A PHASE-SPACE RECONSTRUCTION OF QUANTUM STATISTICS: A REFUTATION OF THE BELL–WIGNER LOCALITY ARGUMENT. Bub, J. (Univ. of Western Ontario, London). Found. Phys.; 3: No. 1, 29-44 (Mar 1973).

Bell's argument that only "nonlocal" hidden variable theories can reproduce the quantum statistical correlations of the singlet spin state in the case of two separated spin-$\frac{1}{2}$ particles is examined in terms of Wigner's formulation. It is shown that a similar argument applies to a single spin-$\frac{1}{2}$ particle, and that the exclusion of hidden variables depends on an obviously untenable assumption concerning conditional probabilities. The problem of completeness is discussed briefly, and the grounds for rejecting a phase-space reconstruction of the quantum statistics are clarified. (auth)

29424 POSSIBILITY OF A MORE REALISTIC INTERPRETATION OF QUANTUM MECHANICS. Rayski, J. (Jagellonian Univ., Krakow). Found. Phys.; 3: No. 1, 89-100(Mar 1973).

The old-fashioned concept of state is shown to be inadequate and misleading. Replacing it by a concept of information and taking advantage of the invariance of the mechanical description under time reversal puts the problems of the interpretation of quantum mechanics in a new light. A more realistic interpretation appears to be possible. Moreover, a new explanation of the Einstein–Podolsky–Rosen paradox is presented, too. (auth)

29425 GENERALIZED SCHROEDINGER QUANTIZATION. Finkel, R. W. (St. John's Univ., Jamaica, NY). Found. Phys.; 3: No. 1, 101-108(Mar 1973).

Schrödinger's original quantization procedure is extended to include observables with classical counterparts described in generalized coordinates and momenta. The procedure satisfies the superposition principle, the correpondence principle, Hermiticity requirements, and gauge invariance. Examples are given to demonstrate the derivation of operators in generalized coordinates or momenta. It is shown that separation of variables can be achieved before quantization. (auth)

29426 NATURAL PHILOSOPHY OF QUANTUM MECHANICS BASED ON INDUCTION. Elsasser, W. M. (Univ. of Maryland, College Park). Found. Phys.; 3: No. 1, 117-137(Mar 1973).

A systematic effort is made to express some of the general results of quantum mechanics in a conceptual form closer to ordinary language than is the case with most modern physics. Many of the implications of the theory appear much more clearly thereby, in particular the fact that the laws of quantum mechanics are only statistical propositions about classes, not referring to individual objects. Conversely, the microscopic structure of an object cannot be precisely defined in quantum mechanical terms. To say that an object has a definite microscopic structure is an operationally meaningless statement; it is on the same level as saying in relativity that a selected coordinate system is "at rest." This raises the need for a "theory of matching": What is the best statement about the structure of an object, given that the tools of description are only statistical? A technique is known for this: the theory of inductive probabilities. There is no longer one true description but a manifold of statistical descriptions, some of which have a greater likelihood of being satisfactory than others. The main concrete application of this type of conceptual reasoning lies in its power to clean out the speculative underbrush which so far has prevented the transition from theoretical physics to theoretical biology. (auth)

29427 CONSTRUCTION OF WAVE FUNCTIONS OF QUANTUM SYSTEMS WITH THE SYMMETRY OF G_2. Sviridov, D. T.; Smirnov, Yu. F.; Tolstoi, V. N. (Inst. of Crystallography, Moscow). Dokl. Akad. Nauk SSSR; 206: No. 6, 1317-1320(21 Oct 1972). (In Russian).

A procedure is described for constructing wave functions for various quantum systems with symmetry G_2, using an operator projection method developed by R. M. Asherova (1969, 1971). The operator projection method is sufficiently universal to be applicable to the two cases of irreducible representations of the G_2 group. (KSW)

29428 VIBRATIONS OF A QUANTIZED VORTEX IN A WEAKLY INTERACTING BOSE FLUID. Rowlands, G. (Univ. of Warwick, Coventry, Eng.). J. Phys., A (London); 6: No. 3, 322-328(Mar 1973).

The vibrations of a quantized vortex are studied in the long wave-length limit. It is shown that the frequency is proportional to the square of the wave number in contradistinction to previous work. (auth)

29429 REEVALUATION OF THE FUNDAMENTAL PHYSICAL CONSTANTS. Cohen, E. R. (North American Rockwell Corp., Thousand Oaks, CA); Taylor, B. N. pp 543-563 of Atomic Masses and Fundamental Constants. 4. Sanders, J. H. (ed.). London; Plenum Press (1972).

From fourth international conference on atomic masses and fundamental constants; Teddington, UK (6 Sep 1971). See CONF-710931–.

This paper is a progress report on current efforts to revise and update the comprehensive review of the fundamental physical con-

stants by Taylor et al. (Rev. Mod. Phys.; 41: 375 (1969)). Although many new data have become available since that review, the dominant problem present at that time is still present, namely, the inconsistency of the value of Craig, et al., for the faraday and the various μ'_p/μ_N measurements. By contrast, the additional new measurements of μ'_p/μ_N and the revision of the result of Sommer, et al., have now removed the internal inconsistencies among the μ'_p/μ_N data which were present in 1969. The other problem which faced Taylor, et al., concerned the QED data. These authors believed that only the hydrogen hyperfine splitting and its theoretical equation were sufficiently reliable to warrant inclusion in a least-squares adjustment to obtain a set of best or recommended constants. The situation has, of course, improved considerably since then with the resolution of the Lamb shift discrepancy by Applequist and Brodsky, the improved measurement of a_e by Wesley and Rich along with the calculation of the a (6) term in the theoretical expression for a_e by Wright and Levine, the improved muonium hyperfine splitting measurements and determinations of μ_μ/μ_p, and, finally, the three new measurements of $(\Delta E\text{-}S)_H$. The third most important question facing Taylor, et al., was how to handle the x-ray data. Because of their overall inconsistency and high uncertainty, they were discarded with the exception of the two N Λ^3 values. Now, however, there are two new x-ray measurements, one of Λ and one of λ_C, which must be considered for possible inclusion in any final adjustment. All other difficulties are at the few tenths ppM level, which is of little importance at the present level of uncertainty for the majority of the constants of interest. (UK)

29430 QUANTUM MECHANICS OF CHIRAL DYNAMICS. Charap, J. M. (Queen Mary Coll., London). J. Phys., A (London); 6: No. 3, 393-408(Mar 1973).

A quantum-mechanical model of chiral invariance is studied, with particular emphasis on problems relating to the order of noncommuting factors. The difficulties which arise from an incorrect use of the Lagrangian are discussed. Using the canonical approach it is shown that the requirement of chiral invariance suffices to remove all ambiguities in the Hamiltonian, which is then given in a form analogous to that of the Sugawara model. A review, often critical, is made of related discussions by other authors. (auth)

29431 TIME NONSPECIAL QUANTUM MECHANICS. Cohen, H. A. (La Trobe Univ., Bundoora, Australia). Acta Phys. Austr., Suppl.; No. 9, 851-855(1972).

From 11th international conference on elementary particle physics; Schladming, Austria (21 Feb 1972). See CONF-720224-.

A reformulation of quantum mechanics is described in which the z co-ordinate has the special role with regard to the three other space-time co-ordinates that the time t has in the usual formulation. (auth)

29432 THREE TURNING-POINT PROBLEM. Wald, S. S.; Lu, P. (Arizona State Univ., Tempe). Lett. Nuovo Cim.; 6: No. 11, 423-426(17 Mar 1973).

The three-turning-point problem is solved by constructing a model problem that contains three turning points and then applying the modified WKB approximation to the second order in $\hbar$. A very good agreement in phase shifts is obtained. (2 figures, 1 table) (RWR)

29433 HYPERSPHERE COORDINATE METHOD IN THE THREE-BODY PROBLEM. Jimenez, S. A. C. Mexico City; Universidad Nacional Autonoma de Mexico (1972). 171p. (In Spanish).

Thesis.

The object of the present study is to establish the hypersphere coordinate method in the quantum analysis of many-body systems. Thus the steps of which this method consists in the study of the three-body quantum problems are shown explicitly. The method to be followed in the case of N bodies is indicated. The hypersphere coordinate method and its application to the study of the three-body problem are first presented. Atomic systems are then studied from the viewpoint of this method, particularizing the study to the two-electron atom. The obtaining of transformation parentheses which simplify the calculation of the matrix elements in the three-body problem is treated. These parentheses are the six-dimensional analog of the Moshinsky–Talmi transformation parentheses. (tr-auth)

REACTOR TECHNOLOGY

Power Reactor Development

Refer also to abstracts 27761, 28334, and 29809.

29434 LMFBR PROGRAM IN THE U. S.: LATEST DEVELOPMENTS. Com. Naz. Energ. Nucl., Notiz.; 18: No. 11, 68-72(Nov 1972). (In Italian).

A discussion of the latest developments of the LMFBR Program as a result of the signing of the Memorandum of Understanding by the AEC, Commonwealth Edison and the Tennessee Valley Authority for the construction and operation of the first LMFBR prototype, is reported. (auth)

29435 NUCLEAR POLICY REVISED AGAIN IN BRITAIN. Com. Naz. Energ. Nucl., Notiz.; 18: No. 11, 61-67(Nov 1972). (In Italian).

Considerations concerning the situation of nuclear energy in Great Britain and the planned restructuring of the nuclear industry are reviewed. (auth)

29436 NUCLEAR REACTOR HAVING A MODULAR CORE. Van Santen, Aart; Sodergard, B. (to Allmanna Svenska Electriska Aktiebolaget). U. S. Patent 3,713,971. 30 Jan 1973. Priority date 2 Dec 1968, Sweden. 16p.

A nuclear reactor includes a reactor core and a pressure vessel surrounding the reactor core. A plurality of tubes pass through the bottom part of the vessel and extend towards the core. These tubes have upper ends forming guide tubes for control rods. The core is formed of a plurality of core units each comprising a fuel assembly and a rod movable in one of the control rod guide tubes. The fuel assemblies are substantially polygonal in cross section and are arranged in a polygonal lattice. Each of the fuel assemblies rests on a separate control rod guide tube. The fuel assemblies are arranged close together with at most only a small gap between them and are laterally supported by the adjacent fuel assemblies and the control rod guide tubes. (Official Gazette)

29437 ATOMIC ENERGY IN THE UNITED STATES IN 1992. Larson, C. (Atomic Energy Commission, Washington, DC). Int. At. Energy Agency Bull.; 14: No. 6, 56-62(1972).

29438 SURVEY OF NUCLEAR POWER IN THE UNITED KINGDOM. Hill, J. Int. At. Energy Agency Bull.; 14: No. 6, 46-53(1972).

29439 INDIA, PAST ACHIEVEMENTS AND FUTURE PROMISES. Sethna, H. N. Int. At. Energy Agency Bull.; 14: No. 6, 36-44(1972).

29440 NUCLEAR PROSPECTS IN FRANCE. Int. At. Energy Agency Bull.; 14: No. 6, 24-30(1972).

29441 CANADA, THE CANDU AND THE FUTURE. Gray, J. L. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Int. At. Energy Agency Bull.; 14: No. 6, 10-15(1972).

29442 FEDERAL REPUBLIC OF GERMANY, PROSPECTS FOR NUCLEAR ENERGY FROM 1972-1992. Hilger-Haunschild, H. (Federal Ministry for Education and Science, Bonn). Int. At. Energy Agency Bull.; 14: No. 6, 16-23(1972).

29443 DEVELOPMENT OF NUCLEAR ENERGY IN THE REPUBLIC OF ARGENTINA. Int. At. Energy Agency Bull.; 14: No. 6, 2-9(1972).

29444 APPLICATION OF FINITE ELEMENT METHOD TO BOILING WATER REACTOR POWER PLANT. Mizumachi, W. (Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan). Toshiba Rebyu; 27: No. 11, 1018-1022(Nov 1972). (In Japanese).

Stress and vibration analyses by the finite element method for nuclear power plants are presented. The remarkable advantage of this method lies in the fact that it has complete generality with respect to geometry, material properties and boundary conditions. The problem of nonlinearity can easily be treated by this method. The plotting system and the automatic input data generation scheme are applied in order to avoid the inevitable quantity of output and input by specifying the geometry and the topology. (auth)

29445 ADVANCED NUCLEAR REACTORS. Caprioglio, P. (CCR-Euratom, Ispra, Italy). Energ. Nucl. (Milan); 20: No. 2, 75-80(Feb 1973). (In Italian).

The status of advanced nuclear reactors in the world including heavy water reactors, high temperature gas reactors, fast and thermal breeder reactors is reviewed. It is particularly emphasized that the industrial maturity of heavy water and high temperature reactors can be considered as practically achieved, and mention is also made of their possible use "in symbiosis," which would allow nuclear energy to cover, through hydrogen production coordinated with electric power, the whole energy market. (auth)

29446 ELECTRIC UTILITIES AND BREEDER REACTORS. Angelini, A. M. (Ente Nazionale Energia Elettrica, Rome). Energ. Nucl. (Milan); 20: No. 2, 81-87(Feb 1973). (In Italian).

Characteristics and purposes of breeder reactors are first considered and discussed, with particular reference to sodium fast breeders; the state of development and commercial prospects of these reactors are then examined; finally a description is given of the joint program among the three main electric power producers in Europe for the construction of two large fast reactor plants. The survey of these topics is dealt with substantially from the electric power utility viewpoint. (auth)

Physics and Core Engineering

29447 (AREAEE-160) PHYSICS, THERMAL, AND HYDRAULIC SIMULATOR MODEL FOR BWR CALCULATIONS. El-Saiedi, A. F. (Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.). 1972. 23p. Dep NTIS (U. S. Sales Only) $3.25.

A detailed description of a numerical model for boiling water reactor calculations is presented. The model is based on dividing the core to small nests (or nodes) for which a complete set of equations describing its behavior is written. A series of iteration loops are used to perform the different functions. The physics part of this model is taken from the GE-FLARE code. Internationally accepted correlations are used in the thermal and hydraulic analysis. (auth)

29448 (NIIAR-P-133) INVESTIGATIONS OF TEMPERATURE DISTRIBUTIONS IN THE BOR-60 CORE. Kazachkovskii, O. D.; Antipin, G. K.; Gryazev, V. M.; Kevrolev, V. P.; Kondrat'ev, V. I.; Krasnoyarov, N. V.; Krupkin, L. K.; Korneev, V. I.; Lukasevich, B. I.; Markin, S. A.; Masnii, V. F.; Smirnov, A. M. (Scientific Research Atomic Reactor Inst., Melekess (USSR)). 1972. 30p. (In Russian). INIS.

The temperature distribution and fuel burnup in fuel rod bundles of the core of the BOR-60 reactor were investigated. The coefficients of non-uniformity of the temperature distribution in the core and the permissible levels of reactor power were determined for a given loading. The overall coefficient of non-uniformity of temperature distribution in the BOR-60 reactor (allowing for the non-uniformity of heating up along the core radius) including the non-uniformity of temperature distribution in the fuel bundles, the effects deviations in fuel weights, and the effects of the distribution in discharge between the core and the lateral shielding for a discharge through the reactor of over 600 m^3/hr, proved to be equal to 2. (tr-auth)

29449 NUCLEAR REACTOR. Arlaud, J. C. (to Commissariat a l'Energie Atomique). French Patent 2,119,834. 11 Aug 1972. Filed date 18 Dec 1970. 10p. (In French).

A fast neutron liquid metal (particularly Na) cooled reactor is described. The liquid metal is at least partially vaporized in the core and gives up heat to a secondary fluid circulating in the tubes of one or several heat exchangers separated from the reactor core. The circulation of the Na across the reactor core and the exchangers results from natural convection between the core, where the Na boils at a constant pressure and temperature, and the exchangers, where the Na vapor is condensed and thus returned to the liquid state and led back the core. Helium can be used as the secondary fluid. (FR)

29450 PLUTONIUM PRODUCTION IN PRESSURIZED WATER REACTORS. Skvortsov, S. A. (Inst. for Atomic Energy, Moscow). Kernenergie; 15: No. 8, 249-252(Aug 1972). (In German).

Plutonium production is relevant in light of the planned application of fast breeder reactors. Conditions are discussed which make plutonium production in pressurized water reactor power plants, in addition to generation of electric power, economically favorable. It is useful to chance loss of burnup in favor of cheap plutonium production. A comparison of the investment cost necessary for production of the same amount of plutonium in pressurized water reactors and converter reactors gives evidence of advantages for the pressurized water reactor. (auth)

29451 THERMAL BREEDER REACTORS. Perry, A. M.; Weinberg, A. M. (Oak Ridge National Lab., TN). Annu. Rev. Nucl. Sci.; 22: 317-354(1972).

Information on thermal breeder reactors is presented con-

cerning physics calculations, economics, and engineering aspects. (DCC)

29452 INFLUENCE OF OPERATIONAL AND GEOMETRICAL PARAMETERS ON THE CRITICAL POWER OF A BOILING WATER REACTOR CHANNEL. Bergel'son, B. R.; Dostov, A. I.; Zorikoev, G. A. Therm. Eng. (USSR) (Engl. Transl.); 18: No. 10, 106-110 (Oct 1971).

Translated from Teploenergetika; 18: No. 10, 72-76(Oct 1971).

The maximum allowable capacity of a steam generating channel in a boiling water reactor is determined from the condition of ensuring the necessary margin with respect to burnout. (auth)

Control Elements, Systems, and Instrumentation

29453 (RDT-E-6-18-T(2-73)) INSTRUMENT TREE FOR SODIUM COOLED REACTORS (FABRICATION ONLY). Division of Reactor Development and Technology (AEC), Washington, D. C.). Feb 1973. 28p. RSO.

A standard for the fabrication, quality assurance, packaging, and delivery requirements of instrument trees for liquid sodium cooled reactors is presented. (auth)

29454 ASSEMBLY CONTAINING A CONTROL ROD. Yellowlees, J. M.; Bouchez, A. (to Societe Belge pour l'Industrie Nucleaire). Belgian Patent 785,099. 19 Jun 1972. 7p. (In French).

An assembly containing a control rod for a fast neutron reactor cooled by a stream of ascending gas is described. The assembly consists of an outer can that surrounds an inner can in such a way as to form a vacuum between them, the inner can constituting a cavity in which the control rod slides which is provided with channels for the flow of the coolant. (tr-auth)

29455 SAMPLE SYSTEM FOR REACTOR EFFLUENTS. Sheppard, L. F.; Gwosdz (Monsanto Co., St. Louis). Instrum. Technol.; 19: No. 12, 38(Dec 1972).

The operation of a system which can sample a high temperature stream which has a high dewpoint, polymerizes readily, and changes composition if stagnant, e.g., steam in reactor cooling systems, is described. The sampler consists of a probe, separator (tar trap), filter, eductor, and valves. Plugging and other problems which occurred during performance testing of the sample system are discussed. (LCL)

29456 PROCEDURE AND EQUIPMENT FOR THE MEASUREMENT OF THE DISTRIBUTION OF BREEDING RATIO AND POWER IN A FAST BREEDER REACTOR. Goldstein, N. P.; Sun, K. H. (to Westinghouse Electric Corp.). German Patent 2,155,204. 18 May 1972. 31p. (In German).

A procedure is described in which several probes which are made partly of breeding material are ordered in a definite grouping in reactor cores and are irradiated there for a definite time. Radiation measurements are carried out on the probes which are kept in their grouping in the reactor core. The intensity of radiation of each probe is determined. The probe material and the measuring methods are further topics discussed. (GF)

29457 PROCEDURE FOR THE REVERSIBLE VARIATION OF THE BORIC ACID CONCENTRATION IN THE COOLING WATER OF NUCLEAR REACTORS. Graemer, G.; Wittrowsky, G. (to Siemens AG). German Patent 2,050,380. 20 Apr 1972. 9p. (In German).

A procedure is described in which part of the primary cooling water is passed over inorganic substances with a temperature-dependent adsorbing capacity for boric acid, and in which the boric acid concentration is varied by changing the adsorption equilibrium via a variable adjustment of the temperature of the adsorbent from about 20°C up to the highest permissible temperature of the cooling agent in the primary cooling circuit. Hydrated oxides (oxihydrate gels) of zirconium, titanium, thorium, tungsten, tin, and/or silicon which are difficult to dissolve are used as inorganic adsorbents. The boric acid concentration is measured with conventional automatic devices. (GF)

29458 VIBRATION MEASUREMENTS IN A PWR: INSTRUMENTATION. Carteus, M.; Gopal, R. (Westinghouse Nuclear Energy Systems, Pittsburgh). Advan. Instrum.; 26: 639.1-639.4 (1971).

From 26th annual ISA conference and test measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt.2).

The instrumentation system for measuring the mechanical vibration behavior of a PWR is described. Instrumentation layout as well as signal preamplification conditioning and processing are detailed. Separation of the instrumentation system into a preamplification system and a signal conditioning-processing system is illustrated and its advantages over a centralized (inside the vapor containment) system are shown. A description is given of both on-site and off-site signal analysis techniques. Advantages of on-site signal analysis are shown with regard to test optimization. The last section relates to the system sensitivity and the resolution obtained from the off-site data reduction techniques. (auth)

29459 IN-CORE NEUTRON FLUX DISTRIBUTION MEASUREMENT BY A CIRCULATING FLUID ACTIVATION METHOD. Fujii, M. (Atomic Energy Research Lab., Kawasaki, Japan). Nucl. Sci. Eng.; 50: No. 3, 302-306(Mar 1973).

An activation method is proposed for in-core neutron flux distribution measurement. A neutron flux distribution being considered is transformed into integral activities by using an activation fluid circulating through a core. Then a set of measured integral activities is transformed inversely to a neutron flux distribution which is approximated by a series of shape functions, such as the Fourier series. Numerical simulation of the results reveal that typical axial neutron flux distributions in a boiling water reactor can be measured within an accuracy of ±15%. (auth)

29460 DEVICE FOR COUPLING NUCLEAR REACTOR CONTROL RODS TO DRIVE LINKAGE THEREFOR AND FOR MAINTAINING CONTROL RODS IN REACTOR CORE. Schabert, H. P.; Pawlitzki, R. (to Siemens Aktiengesellschaft). U. S. Patent 3,720,580. 13 Mar 1973. Priority Date 7 Dec 1968, Federal Republic of Germany (F.R. Germany). 6p.

A method of coupling nuclear reactor control rods, displaceable in guide tubes and around which coolant flows in a nuclear reactor, to a drive linkage and uncoupling the control rods from the drive linkage is described. It includes turning a one-piece drive linkage with respect to a control rod located in the reactor shut-off location, and turning the control rod proper with the aid of the drive linkage with respect to a guide tube in which the control rod is received for the purpose of locking and unlocking the control rod. (Official Gazette)

29461 USE OF DATA PROCESSING SYSTEMS IN NUCLEAR POWER PLANTS AND INVESTIGATION OF THE OPERATING RESULTS. Maljutin, J. M.; Kulikov, N. J. Arch. Energiewirt.; 26: No. 24, 1208-1214(1972). (In German).

The description of a central system for a block consisting of reactor and turbine is followed by a report on the operating results of this system. (GF)

29462 RELIABILITY OF ELECTRONIC REACTOR PROTECTION SYSTEM COMPONENTS OF LATEST TECHNOLOGY. Weil, L. (Technical Univ., Munich). Kerntechnik; 14: No. 11, 540-545 (Nov 1972). (In German and English).

The use of the latest technological developments in the construction of reactor electronic protection systems, and the associated substantial reduction in the number of active and of passive system components, also reduce drastically the number of possible component faults. The eliminated components, however, are largely those causing safe faults, this being the reason why the reduction in these faults is particularly striking. In the few remaining components, by contrast, the percentage of possible faults resulting in dangerous failures is noticeably higher. This is compensated, however, by the higher quality of these components, reflected in very low failure rates. Taking this into account, the final result is that the use of integrated semiconductor circuits makes it possible markedly to reduce not only the overall failure probabilities but also the probabilities of occurrence of dangerous faults. (auth)

Containment Systems, Shielding, Waste Processing, and Radiation Protection

Refer also to abstract 27661.

29463 LINEAR AND NONLINEAR THERMAL GRADIENTS: AN INTERPRETATION OF THE NUCLEAR COMPONENT CODE. Section III. Wright, B. W. (Westinghouse Electric Corp., Pittsburgh). Nucl. Eng. Des.; 23: No. 2, 179-182(1972).

The nuclear Components Code requires a detailed stress analysis, including the stresses caused by the transient temperature gradient across the thickness of the pressure boundary. By Code definition, this thermal stress is composed of a linear portion (causing secondary stresses) and a nonlinear portion (causing peak skin stress). Using the across-the-thickness thermal transient as a basis of definition, the general expression for the linear and nonlinear portions of the transient is derived. This derivation may be directly incorporated for evaluation of linear and nonlinear thermal stresses by a minor modification to a standard transient analysis computer code. (auth)

29464 DYNAMIC ANALYSIS OF AXISYMMETRIC SHELLS UNDER ARBITRARY TRANSIENT PRESSURES. Godfrey, D. A.; Moussa, M. M. (Duke Power Co., Charlotte, NC). Nucl. Eng. Des.; 23: No. 2, 187-194(1972).

A method of dynamic analysis of a free-standing steel containment vessel under transient loads is outlined. The containment vessel is composed of a vertical cylinder, hemispherical dome and a flat base. The bottom plate functions only as a leak tight membrane with no structural capability. The cylindrical part of the vessel is reinforced by both vertical and ring stiffeners. The transient loads on the shell are the pressures caused by a loss-of-coolant accident due to a postulated rupture of a reactor coolant pipe. The pressures are time-dependent and vary both in the meridional and circumferential directions. The finite element method is used in the analysis and the direct integration approach through the time domain is utilized. The results of analysis are the displacement and stress resultant time histories at the nodal points. (auth)

29465 COMPOSITE PRESSURE SUPPRESSION CONTAINMENT STRUCTURE FOR NUCLEAR POWER REACTORS. Kennedy, W. J. L.; Miczek, C. B.; Barabedian, G. (to Stone and Webster Engineering Corp.). U. S. Patent 3,713,968. 30 Jan 1973. Filed date 3 Oct 1968. 8p.

A nuclear power reactor pressure suppression containment system wherein the primary containment includes a biological shielding, vapor barrier and strength member, all of which are constructed and function as a composite structure is described. A conically shaped concrete pressure vessel internally lined with a gas-impervious membrane comprises the primary containment. A support structure centrally positioned within the primary containment carries the reactor vessel and internal floor independently of the primary containment vessel, the internal floor separating the drywell from the pressure suppression chamber. A secondary containment comprising a cylindrical concrete vessel houses the primary containment vessel and is also supported independently thereof on a common foundation. (8 claims, 1 drawing figure) (Official Gazette)

29466 TRANSIENT TEMPERATURE DISTRIBUTION IN A CONCRETE BIOLOGICAL SHIELD OF A NUCLEAR POWER REACTOR. Eberwein, J. (Siemens AG, Erlanger, Ger.). Siemens Forsch.-Entwicklungsber.; 1: No. 4, 341-349(1972).

For the case of failure of the shield cooling system, a general formula has been developed for calculating the transient temperature distribution in the biological wall which is exposed to gamma and neutron energy deposition. To permit convenient calculations, the functions found were evaluated and plotted in diagrams dependent on the Fourier number, wall parameter and linear attenuation coefficient for gamma rays. By two examples it is shown how the temperature rises in the shield wall with the outage time of the shield cooling system if power station operation is continued after shield cooling failure. Power station shutdown will then depend on the restoration of shield cooling. (GF)

29467 CONTROL MECHANISM FOR AIR-LOCK DOORS, PARTICULARLY FOR NUCLEAR REACTOR AIR-LOCKS. (to Dinglerwerke AG). Belgian Patent 1,577,516. 3 Jun 1969. Priority date 24 Jun 1967, Federal Republic of Germany (F. R. Germany). 7p. (In French).

A control mechanism for air-lock doors is described. The drive shaft of one door and the locking mechanism of the other are provided with a safety device so that the shaft can not be turned if the second door is closed and locked. The two doors or the safety device can be moved after release of a safety lock. (JSR)

Cooling Systems

Refer also to abstracts 27284, 27360, and 27762.

29468 (DP-Report-651) THEORETICAL ANALYSIS OF FLOW INSTABILITIES IN THE DRAGON PRIMARY HEAT EXCHANGERS. Dragon Project. Davies, A. L. (Atomic Energy Establishment, Winfrith (England)). Jun 1969. 28p. Dep. NTIS (U. S. Sales Only) $3.50.

A theoretical analysis of the present heat exchangers has confirmed that without inlet orifices they are unstable in the parallel channel mode. Inlet orifices of 4.5mm dia. stabilise the flow against divergent oscillations up to a reactor power level of about 22MW, but the stability margin is small and the damping inadequate at power levels of 15 to 20MW. The small stability margin is associated with a resonance which changes in magnitude and frequency with power level in the same way as the observed flow fluctuations. It is concluded that the observed flow fluctuations are due to the amplification of inherent noise in a system without adequate damping. A similar analysis of the new heat exchanger design with Incoloy 800 tubes in a redesigned secondary circuit and with new pumps has been carried out at 25MW reactor power and the required secondary circuit flow of 150 gpm. With an available pump head of about 110 psi the smallest inlet orifices which will give the required flow are 3.8 mm dia. The flow is then stable against divergent oscillations, and the noise amplification is about the same as in the present heat exchangers at 12MW reactor power. If a lower flow rate were acceptable, the noise amplification can be reduced and stability increased by reducing the size of the orifices. For instance with 3.5mm orifices the noise amplification would be less than in the present heat exchangers at 10MW, the flow rate would drop to 140 gpm at 25MW but 150 gpm would be obtained at 20MW. (11 references) (auth)

29469 (DP-Report-664) AN ASSESSMENT OF THE OPERATING CHARACTERISTICS OF THE PROPOSED MODIFIED SECONDARY COOLANT CIRCUIT FOR THE DRAGON REACTOR. Dragon Project. Cooper, A. A. (Atomic Energy Establishment, Winfrith (England)). Nov 1969. 32p. Dep. NTIS (U. S. Sales Only) $3.75.

Steady state circuit characteristics have been produced for a modified Dragon secondary coolant circuit including gags at entry to each heat exchanger tube. These characteristics cover a range of reactor powers up to 25 MW and are intended for use in identifying pump head and flow requirements for the satisfactory operation of the circuit. The natural circulation capability of this circuit has also been studied, covering a range of thermal powers up to 20% of the proposed full power level of 25 MW. (8 references) (auth)

29470 DESIGN, TESTING, AND OPERATIONAL BEHAVIOR OF PRESTRESSED CONCRETE PRESSURE VESSELS. Hornby, I. W. (Central Electricity Research Labs., Leatherhead, Eng.). J. Inst. Nucl. Eng.; 14: No. 1, 4-10(Jan 1973).

The following aspects of prestressed concrete pressure vessels are discussed: vessel dimensions; prestressing; liner and cooling; elastic, ultimate, and creep analysis; instrumentation; model testing; materials testing; prestress fittings; proof testing of full-size vessel; operational behavior; and future development. (UK)

29471 KONSTRUKTIVNYE FORMY I METODY RASCHETA YADERNYKH REAKTOROV. Izdanne vtoroe, pererabotannoe i dopolnennoe (Construction of Nuclear Reactors and Methods of Calculation. Second edition, revised and enlarged). Mel'nikov, N. P. Moscow; Atomizdat (1972). 552p.

Reactor vessel construction for nuclear power stations is discussed. Steel fabrication and assembly, layout, and methods of calculation, optimum dimensions, material requirements, and welding problems are considered. Procedures for evaluating vessel stress and deformation, thermal fatigue, shock, and creep, and limiting pressure for vessels of given shapes are offered. 277 references. (KSW)

29472 MECHANISM FOR PREVENTING COOLING DISTURBANCES OR POWER EXCURSIONS. Schmidt, G. German Patent 2,055,455. 18 May 1972. 3p. (In German).

The patent claims refer to a device for the prevention of operating disturbances due to superheating of the coolant in a liquid-metal cooled breeder reactor. For this purpose, an appropriate material continuously regenerating helium or hydrogen nucleates is provided for in at least one coolant passage between the fuel elements in the reactor core. These helium or hydrogen nucleates will induce nucleate boiling in case the coolant reaches its boiling temperature. They are produced by nuclear events. (GF)

29473 RADIATIVE HEAT TRANSFER BY SOLID SUSPENSION LAMINAR FLOW WITH RADIATING FLUID IN A CIRCULAR TUBE WITH CONSTANT WALL TEMPERATURE. Echigo, R.; Hasegawa, S.; Takechi, E.; Okamoto, Y. (Kyushu Univ., Japan). Nippon Genshiryoku Gakkaishi; 14: No. 12, 661-667(Dec 1972). (In Japanese).

In order to improve the heat transfer characteristics in gas cooled nuclear reactors, there have been proposed in the past a number of devices for improving heat transfer, among which the gaseous suspension of solid fine particles would appear to be the most promising, on account of the good absorption of thermal radiation provided by the particulate cloud. An analysis has been performed on the heat transfer by radiating gaseous suspension laminar flow in a circular tube with constant wall temperature, taking account of the thermal radiation to both particulate and carrier (fluid) phases simultaneously. The results obtained for the temperature profiles and heat transfer characteristics are summarized for wide ranges of dimensionless parameters such as the radiation-conduction parameter N_R, the optical radius of multiphase medium of duct τ_{mo}, the thermal loading ratio of particles to fluid Γ and so forth. An extensive discussion is also given on comparisons of results with those of non-radiating gaseous

suspension flow and of radiating gaseous flow without particulate load (single phase). (auth)

29474 COMPARISON OF SINGLE AND MULTICELL HEAT TRANSFER ANALYSES NEAR NUCLEAR REACTOR ASSEMBLY WALLS. France, D. M.; Ginsberg, T. (Argonne National Lab., IL). Nucl. Eng. Des.; 23: No. 2, 141-146(1972).

A "multicell" approach to the problem of heat transfer near the wall of a nuclear reactor fuel assembly is compared to the "single cell" approach. Steady state, fully developed heat transfer is considered in assemblies without grid or wire spacers. Results of the multicell approach indicate significant discrepancies in temperature predictions occur when calculations are based on eight fuel elements as compared to the results based on a single fuel element (cell). The multicell analysis includes the effect of mass flux distribution across the subassembly, and the resulting heat transfer trends are not consistent with the single cell approach. These trends are discussed and the utility of the multicell approach is demonstrated. (auth)

29475 BOILING WATER REACTOR PLANT. Florjancic, D. (to Sulzer Brothers Ltd.). U. S. Patent 3,715,271. 6 Feb 1973. Priority data 1 Jul 1970, Switzerland. 6p.

A boiling water reactor is described in which a socket serves as an inlet for feed water and as a housing for the turbine shaft which drives the pump. The socket includes a duct which delivers feed water directly into the water chamber as well as a duct for feeding the water discharged from the turbine into the water chamber via the pump. (Official Gazette)

29476 NUCLEAR REACTOR POWER PLANT STRUCTURAL SUPPORT SYSTEM. Van Sickel, A. L.; Mitchell, E. S.; Rigamonti, G. (to Stone and Webster Engineering Corp.). U. S. Patent 3,716,451. 13 Feb 1973. Filed date 30 Nov 1970. 12p.

A structural support system for the steam generators and reactor coolant circulating pumps of a nuclear power plant is described in which each steam generator is carried in a lower frame support mounted on linear slides and also is supported by an upper ring to which there is secured four equi-spaced hydraulic snubber assemblies mounted to the charging floor of the power plant at perpendicular directions to each other. Each reactor coolant pump is carried in a pivotally mounted frame support adjacent its associated steam generator. Hydraulic snubber assemblies extend between each steam generator and its associated reactor coolant pump and between the reactor shield wall and each of the steam generators and reactor coolant pumps. (Official Gazette)

29477 BOILING PRESSURE DROP BEHAVIOR FOR SODIUM FLOWING IN MULTIPLE, INTERCONNECTED CHANNELS. Baroczy, C. J.; Logan, D.; Morewitz, H. A. (Atomics International, Canoga Park, CA). Chem. Eng. Progr.; Symp. Ser.; 67: No. 119, 81-93(1971).

Experimental data are presented for the boiling sodium pressure drop-flow characteristic, at fixed power, for a group of interconnected channels formed by three heated pins located in a cloverleaf-shaped channel. Numerical results demonstrate that the pressure drop-flow behavior of a group of geometrically identical channels can, under nonuniform heat input conditions, be substantially different from that normally observed for a single channel. Comparison of the data with a multi-channel boiling sodium code shows a reasonable agreement; however, the curve shape is shown to be very sensitive to small changes in flow channel dimensions or geometry. (auth)

29478 ACCIDENTS WITH LIQUID SODIUM. Means of Protection and Safety. de la Torre Cabezas, M. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 16: No. 78, 439-451(1972). (In Spanish).

Sodium represents almost the only coolant liquid metal used in fast reactors. Unfortunately the use of sodium implies a series of potential dangers such as fire and danger to personnel. The characteristics and parameters of sodium fires, the various accidents which can occur, and the damage possible are reviewed. The methods of protection against sodium leaks, for the protection of the building and the system and of personnel, are discussed. The various products used to combat sodium fires are analyzed. (tr-auth)

29479 VIBRATION MEASUREMENTS IN A 3-LOOP PWR: INSTRUMENTATION, ANALYSIS, RESULTS. Haensel, D. (Westinghouse Nuclear Energy Systems, Pittsburgh). Advan. Instrum.; 26: 624.1-624.4(1971).

From 26th annual ISA conference and test measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt.2).

Vibration measurements of reactor vessel and reactor internal components were carried out at a typical 3-loop PWR. The instrumentation and the data acquisition system are described briefly. An outline of the data reduction and analysis methods used is given. The description of two particular vibration sources, flow induced vibration of guide tubes and forced excitation of the structure caused by pump generated pressure pulsations, concludes the discussion of results. (auth)

29480 EMERGENCY SHUT-OFF VALVE FOR NUCLEAR REACTORS. Cahill, W. J. Jr. (to Consolidated Edison Co. of New York, Inc.). U. S. Patent 3,713,969. 30 Jan 1973. Filed date 16 Sep 1969. 10p.

A nuclear reactor vessel for containing coolant and/or moderator fluid under high pressure and having an emergency shutoff valve mounted adjacent each of its fluid inlet and outlet openings is described. Each valve is arranged to automatically close its associated opening in the event of rupture of the external fluid piping. The valve disc of each valve has convex, spherical-sector shape, and is mounted by a folded leaf spring and tension pin arrangement to a fixed structure, preferably the reactor core, against which the valve disc is normally held in valve-open position. Upon a bursting of the piping, the valve closes in response to the fluid surge forces which are automatically generated by the suddenly changed fluid flow conditions. (9 claims, 6 drawing figures) (Official Gazette)

29481 METHOD OF OPERATING A NUCLEAR REACTOR FACILITY WITH A STEAM COOLED FAST BREEDER REACTOR AS THE HEAT SOURCE. Ritz, L. (to Gesellschaft fuer Kernforschung mbH). U. S. Patent 3,715,272. 6 Feb 1973. Priority date 16 Apr 1969, Federal Republic of Germany (F. R. Germany). 4p.

A method of operating a nuclear reactor facility is described in which a primary and a secondary cooling cycle are coupled together by means of a heat exchanger, with the primary cooling cycle containing a steam cooled fast breeder reactor and the secondary cooling cycle containing a working unit operated on steam which is generated and superheated in the heat exchanger. A fraction of the steam is superheated in the reactor to complete condensation in the heat exchanger, and the thus produced condensate is mixed with the other fraction of the steam superheated in the reactor to produce live steam which is recycled into the reactor. The coolant for the primary cycle is either entirely or predominantly D_2O. The desuperheating and condensation of the primary coolant in the heat exchanger is performed at a pressure level slightly higher than that of the secondary coolant. (4 claims, 1 drawing figure) (Official Gazette)

29482 NUCLEAR REACTOR HAVING INTERNAL PUMPS. Leine, L.; Gavelefors, S.; Eriksson, O. (to Allmanna Svenska Elektriska Aktiebolaget). U. S. Patent 3,723,247. 27 Mar 1973. Priority date 24 Sep 1968, Sweden. 8p.

In a boiling water reactor having coolant recirculation pumps installed within an annular space between the reactor pressure vessel and an internal core shroud, the pump motors are arranged outside the reactor pressure vessel. The pump shafts penetrate the bottom part of the reactor pressure vessel in vertical shaft bores and the pump impellers are surrounded by pump casings having curved flow passages. The pump casings are rigidly attached either to the shaft bores or to the core shroud and flexibly sealed with respect to the core shroud or the shaft bores. The pump motors may be designed to operate in the reactor coolant and be enclosed in motor housing pressure vessels communicating with the reactor vessel. (Official Gazette)

Fuel Systems and Components

Refer also to abstracts 28273 and 28324.

29483 (CEA-CONF-2204) PHYSICAL AND MECHANICAL PROPERTIES OF NUCLEAR GRAPHITES. Their Application in High Temperature Reactors. Mottet, P.; Rappeneau, J.; Lore, J.; Cornuault, P. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1972. 6p. (In French). Dep. NTIS (U. S. Sales Only). $3.00.

Different kinds of graphite have been studied for their use as fuel element tubes or as moderator blocks in High Temperature Reactors. Among these different kinds of graphite, four have been selected and produced on an industrial scale. The physical, mechanical and thermal properties of these materials are described and their texture has been examined. The results show that these graphites when unirradiated correspond with the operating conditions in HTR. In order to know the irradiation behavior of these materials, experiments have been made in the RAPSODIE, SILOE, OSIRIS, and DRAGON reactors. Although all irradiation experiments are not finished, first results show that the irradiation behavior of these materials can be considered as satisfactory. (auth)

29484 (GEAP-5725) VELOCITY DISTRIBUTION AROUND FUEL PINS IN SODIUM-COOLED FAST REACTORS WITH TRIANGULAR FUEL PIN ARRAYS. Cook, K. W. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation). Dec 1968. 140p. Dep. NTIS $3.00.

The theoretical background and numerical methods for determination of the circumferential and radial velocity distributions for a corner fuel pin in a sodium-cooled reactor are reviewed. In addition to the velocity distributions, the distribution of eddy diffusivities of heat and momentum are obtained. These results provide the necessary input information for calculation of the circumferential temperature distribution using generalized nodal heat transfer computer codes. The methods presented are applicable for triangular array, multiple fuel pin geometries enclosed in a hexagonal channel. The coolant must be a low Prandtl number fluid such as sodium. The results presented are based on typical fast reactor geometries and coolant properties. The digital computer code developed is applicable for analysis of edge fuel pins and interior fuel pins as well as corner fuel pins. 10 references. (auth)

29485 (JUL-903-RW-RX) FIRST KFA STATUS REPORT ON THE GSB RADIATION EXPERIMENT IN THE MOL He LOOP. Krawczynski, S.; Krug, W.; Sachse, K.; Stechemesser, H.; Zeumann, J.; Zumloh, A. (Kernforschungsanlage, Juelich (West Germany)). Oct 1972. 43p. (In German). Dep. NTIS (U. S. Sales Only) $4.25.

The planning concerns a gas-cooled fast breeder (GSB) reactor as a back-up to the sodium fast breeder. The design is a variation on the General Atomic Inc. concept and its testing at Oak Ridge National Laboratory. In the first phase, short-term irradiation will be performed on two identical fuel rod bundles. The second phase envisions burnup to 60,000 MW d/t under operational conditions using He as cooling gas, a pressure of 61 kp/cm^2, a maximal rod power of 500 W/cm^2, and a jacket temperature of 700°C. Studies will center on two points. One series of observations concerns the radiation behavior, under GSB operational conditions, of an aerated fuel rod bundle with steel cladding and oxide fuel. The other series will study the operational behavior of the aeration system for fuel elements under conditions that occur in a GSB power reactor operating over long periods of time. (HBG)

29486 (RT-PROT-(72)36) FAG: CODE FOR THE CALCULATION FOR GREY BODY VIEW FACTORS IN A FUEL ELEMENT. Morici, A.; Principe, D. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 16 Nov 1972. 19p. (In Italian). Dep. NTIS (U. S. Sales Only) $3.00.

A digital computer code for grey-body view factors in the case of a light-water power reactor fuel-bundle is presented. The black-body view factors are input-code. A listing of the code is included. (auth)

29487 (SGAE-2063) ABSORBER MATERIAL FOR GAS COOLED HIGH TEMPERATURE REACTORS: IRRADIATION BEHAVIOR OF COATED LB PARTICLES. Strigl, A.; Bildstein, H.; Falta, G.; Izay, G.; Peschta, G.; Wagner-Loeffler, M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.M.B.H., Seibersdorf. Institut fuer Chemie). Dec 1972. 15p. (In German). (SGAE-CH-89-72). Dep. NTIS (U. S. Sales Only) $3.00.

250 kg of carbon-coated particles containing boron were produced by a new method. The particles had core diameters of from 540 to 710 μm. The thickness of the porous layer ranged from 52 to 72 μm, while that of the high-density PyC layer amounted to about 100 μm. Five samples with a boron content from 0.64% to 1.088% were used in radiation experiments at the ASTRA reactor. Irradiation was performed for 1250 hours at an effective thermal flux of approximately 10^{14}n/cm^2/sec. It was concluded that the particles could be used in an HTGR up to an 80% burn-up of the ^{10}B and temperatures up to 1500°C. (HBG)

29488 (UJV-2888-R) NUMERICAL CALCULATION OF THE NUSSELT NUMBER IN LONGITUDINAL FLOW AROUND AN ASSEMBLY OF FUEL RODS. Pfann, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Jaderneho Vyzkumu). 1972. 55p. (In Czech). Dep. NTIS (U. S. Sales Only) $4.75.

A brief description of a computer program for predicting velocity profiles, temperature distribution and heat transfer in turbulent longitudinal flow through assemblies of fuel rods is presented. The solution applies to infinite triangular or rectangular arrays of fuel rods with velocity and temperature profiles fully developed for fluids with Prandtl number Pr ~ 1 and Pr ≪ 1. The code is written in ALGOL language for GIER computer. The Nusselt number dependence with the dimensionless rod spacing, cladding thickness and its heat conduction has been found for triangular arrays and Pr ≪ 1. The results are plotted in numerous graphs and compared with the data of other investigators. The factors which must be taken into consideration when the results from infinite arrays are applied to fuel elements are described at the end. (8 references) (auth)

29489 FUEL ELEMENT FOR HEAVY-WATER MODERATED REACTORS. Lettau, H.; Kroepfl, H. (to Siemens AG). German Patent 2,052,342. 4 May 1972. 5p. (In German).

The fuel element in question consists of a circular fuel rod bundle with the rods standing parallel. This arrangement is obtained by means of a lattice skeleton of spacer wires. The fuel cladding tubes are provided with diametrical guiding ribs which correspond to axially slotted reinforcements in the lattice skeleton. (GF)

29490 REACTOR COOLING ARRANGEMENTS. Porter, W. H. L. (to United Kingdom Atomic Energy Authority). British Patent 1,295,222. 8 Nov 1972. Filed date 18 Jan 1971. 4p.

As a precaution against the safe heat rating of reactor fuel being exceeded, means may be provided for introducing into at least some fuel channels additional coolant from an independent auxiliary supply. In the arrangement described a non-return valve is provided at the auxiliary coolant inlet; this is arranged to be maintained in the open position by the pressure of coolant entering the channel but to close in response to a pressure difference across the inlet tending to induce flow in a reverse sense; on closure the non-return valve traps coolant within the channel. Details are also given of the fuel support assembly and fuel rod arrangement. (UK)

29491 FUEL ASSEMBLY FOR GAS COOLED REACTORS. Yellowlees, J. M. (to Societe Belge pour l'Industrie Nucleaire). Belgian Patent 785,096. 19 Jun 1972. 5p. (In French).

A fuel assembly for a gas-cooled nuclear reactor consists of an annular layer of coated fuel particles maintained between two perforated plates and cooled by a coolant that flows radially across the bed (layer) characterized by the fact that the annular bed is made up of an assembly of superposed layers. (tr-auth)

29492 FUEL ASSEMBLY FOR FAST REACTORS. Yellowlees, J. M. (to Societe Belge pour l'Industrie Nucleaire). Belgian Patent 785,097. 19 Jun 1972. 7p. (In French).

A fuel assembly for gas-cooled nuclear reactors is described. It consists of an annular bed of coated particles maintained between two perforated walls and cooled by a refrigerant that flows radially across the bed, characterized by the fact that the pressure drop across the bed is regulated, on at least a part of the height of the bed by means of adjusting the local pressure of the coolant at the entrance of the bed, and in which the hot channel of coolant flow is supported along the length of the bed by several support lattices in which the particle assembly is maintained in place by a force preventing the particles from being displaced. (tr-auth)

29493 NUCLEAR FUEL ASSEMBLY WITH REINFORCED FLOW CHANNEL. Venier, D. A.; Smith, B. A.; Lass, J. L. (to General Electric Co.). U. S. Patent 3,715,274. 6 Feb 1973. Filed date 15 Aug 1969. 6p.

A nuclear fuel assembly wherein the lower portion of the flow channel is reinforced or stiffened in the region of its interface with the lower tie plate for improved control of bypass flow of coolant into the spaces between the fuel assemblies of a nuclear reactor, is described. (Official Gazette)

29494 TEMPERATURE FIELDS IN FUEL, CLADDING, AND COOLANT IN FUEL ELEMENTS WITH ECCENTRIC GEOMETRY. Hofmann, F. (Kernforschungszentrum, Karlsruhe, Ger.). Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 55-63(1971).

A theoretical analysis is presented that permits calculation of two-dimensional velocity and temperature fields in the coolant, and three-dimensional temperature fields in the fuel and cladding. The analysis is applied to sodium as coolant with fully developed turbulent flow. Mixing of the coolant is calculated by appropriate equations for the diffusivities of momentum and energy. The results for the temperature and flow velocity fields are presented as function of the eccentricity of the central rod in a hexagonal array for the following cases: pitch to diameter ratio P/D = 1.21, and displacements of the rod ξ = 0; 0.1; 0.2 mm. The results show that small displacements of the rod in tightly packed rod bundles cause considerable temperature variations in the coolant and cladding on the rod periphery. (auth)

29495 LOW QUALITY CRITICAL FLOW EXPERIMENTS IN A FORCED CONVECTION BOILING SODIUM LOOP. Costa, J.; Charlety, P. Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 72-80(1971).

A method is presented to determine if critical flow rates are reached at the exit of a test section in a forced convection boiling loop. The method has been used to demonstrate that, during a flow perturbation, critical conditions may be reached at the exit of a sub-assembly in a sodium cooled fast breeder reactor. The method

has also been used to measure some critical flow rates in a parameter range of interest for fast reactor safety. (auth)

29496 DESIGN OF FUEL ELEMENTS FOR FAST-NEUTRON POWER REACTORS. Golovnin, I. S.; Bibilashvili, Yu. K.; Men'shikova, T. S. At. Energ. (USSR); 34: No. 3, 147-154(Mar 1973). (In Russian).

The difficulty of designing fuel elements for fast power reactors lies in the necessity of combining high energy production and significant accumulation of secondary nuclear fuel under severe operating conditions. An investigation of nuclear-physical, chemical-metallurgical, mechanical, and technological characteristics of a number of fuel and structural materials made it possible to determine the approach to the design of core and blanket fuel elements for fast power reactors. Austenitic stainless steel is the most suitable for fuel-element cladding and will be the dominant structural material during the next ten years. The fast power reactors BH-350 and BH-600 will employ uranium dioxide in the first charges of core fuel, and subsequently it is planned to go over to mixed oxide fuel ($UO_2 - PuO_2$). Fuel element cores of this type will consist of compressed pellets. A judicious application of mechanization and automation will make it possible to exclude manual labor in production processes, while permitting short-term manual intervention in eliminating faults and replacing equipment. (auth)

29497 EXAMINATION AND DISASSEMBLY OF FAILED EBR-II SUBASSEMBLIES. Hampson, D. C.; Paige, D. M.; Brak, S. B.; Taylor, H. A. (Argonne National Lab., IL). Conf. Remote Syst. Technol., Proc.; 20: 46-51(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The experimental fuels irradiated in Experimental Breeder Reactor II (EBR-II) are being taken to higher levels of burnup (10 to 12 at. %). This increases the possibility of failure of the fuels and their cladding. Subassemblies that contain severely failed fuel elements are transferred in a sodium-filled container to the argon cell of the Hot Fuel Examination Facility (HFEF) where detailed examination of the subassembly and its contained fuel elements can be made. These examinations include nondestructive examinations of the subassembly and fuel elements, and destructive examinations and sampling of all the components. (auth)

29498 ELEMENTARY ROD VIBRATION MEASUREMENTS IN A HEXAGONAL ARRAY OF 19 WIRE WRAPPED FUEL RODS WITH PARALLEL FLOW. Graves, A. W.; Davidson, C. R. (Atomics International, Canoga Park, CA). Advan. Instrum.; 26: 625.1-625.5(1971).

From 26th annual ISA conference and test measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt.2).

A 19-rod assembly was instrumented in an elementary fashion and tested for flow induced vibration at 17 to 45 ft/sec water flow velocity. The geometry was prototypic of proposed LMFBRs. The 5-ft long rods were wire wrapped on a 12-inch helical pitch. Each rod had a diametral looseness of 0.005 inch. The instrumentation was kept simple by utilizing the impedance change in an electrolyte caused by a change in probe separation. Electrodes were flush mounted in selected weight simulated rods and in the adjacent hexagonal flow tube wall. The signals were monitored for both amplitude and frequency of rod motion induced by the parallel water flow. The signals had been calibrated to known rod displacements. Power spectral density analysis of the data was performed. Generally, the signals were buried in the noise background, and no signals were recorded with equivalent amplitudes greater than 0.0003 inch. The absence of potentially damaging rod vibration was further verified by inducing rod displacements with an impact energy input at the base of the flow tube and recording the resulting signals. The natural frequency was about 70 Hz, and the periodic vibration signals damped to the noise background in less than one second for all test conditions. (auth)

29499 INSPECTION OF POWER REACTOR FUELS. Harada, T. (Ministry of International Trade and Industry, Tokyo). Karyoku Hatsuden; 23: No. 7, 715-721(Jul 1972). (In Japanese).

Important factors for the safety of fuel elements and items and methods of inspection are given for the fuel of light-water reactors. The important factors in the design and manufacture of the fuel elements are those concerning safety performance. The factors are increase of internal pressure, effect of irradiation, thermal and mechanical stress, corrosion, local temperature rise and defects in cladding. Recommendation was prepared by the Japan Electric Association for the inspection of the fuel elements for power generation. The items of inspection for pellets are rate of uranium enrichment, chemical composition and impurity, appearance, dimensions, density and burnable poison. The items of inspection for cladding are chemical composition and impurity, defects, dimensions, microscopic structure, mechanical properties, corrosion resistance, and appearance. Those for end plugs are chemical composition, mechanical properties, and dimensions. Those for the fuel elements are length and weight of pellet stack, soundness of welded part, surface contamination, appearance and dimensions. Those for fuel assemblies are appearance, dimensions and leakage. (JA)

29500 EXPERIENCE WITH FUEL ASSEMBLIES FOR PRESSURIZED WATER REACTORS. Holzer, R.; Knaab, H. (Siemens AG, Erlangen, Ger.). Kerntechnik; 14: No. 11, 519-525(Nov 1972). (In German and English).

The development of fuel assemblies for pressurized water reactors is traced. Knowledge gained from the performance of fuel assemblies in reactors now in operation as well as detailed experiments on the properties of fuels and cladding and their interactions in the fuel rod during irradiation are discussed. (JWR)

29501 FUEL ASSEMBLY FOR GAS COOLED REACTORS. Yellowlees, J. M. (to Societe Belge pour l'Industrie Nucleaire). Belgian Patent 785,094. 19 Jun 1972. 9p. (In French).

A fuel assembly for gas-cooled nuclear reactors is described characterized by the fact that at least a part of its height is made up of layers of spherical particles of reduced depth traversed by a flow of refrigerant and superposed in a manner to form between them a space for the outflow of the refrigerating gas. (tr-auth)

Auxiliary Systems, Protection Systems, and Engineered Safeguards

Refer also to abstract 28320.

29502 DEVICE FOR MANIPULATING NUCLEAR FUEL ASSEMBLIES. Renaux, C. (to Commissariat a l'Energie Atomique). French Patent 2,124,139. 22 Sep 1972. Filed date 9 Feb 1971. 10p. (In French).

A device for manipulating nuclear fuel assemblies (particularly those of Na cooled reactors) is described. The device incorporates a support and a vessel open at the top. A special part, which accommodates the assembly is provided in the vessel. The device also possesses a bell-shaped housing open at its base and equipped with means for connecting it to the support, the bell-shaped housing being temporarily joined to the support in such a position that its lower edge is situated below the opening of the vessel. The bell-shaped device possesses a U tube, which connects the closed upper part of the bell-shaped housing to the exterior and opens out into the exterior at a level at least equal to that in the bell-shaped housing. (FR)

29503 99% CLEANUP OF NUCLEAR GASEOUS WASTES. Griffith, G. Power Eng.; 77: No. 3, 62-64(Mar 1973).

The fluorocarbon absorption system for the in-plant treatment of radioactive gaseous effluents is described. This system was developed for pressurized water reactors but may be applied to waste gases from boiling water reactors and reprocessing plants. Other near-zero-release systems are mentioned. (JWR)

29504 LMFBR FUEL HANDLING SYSTEM BASED ON SEFOR EXPERIENCE. Franckx, L.; Myers, R. (General Electric Co., Sunnyvale, CA). Contract AT(04-3)-540. Conf. Remote Syst. Technol., Proc.; 20: 14-28(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

SEFOR refueling experience is described to relate its effect on the current design for an LMFBR demonstration power plant. Whereas SEFOR employed one all-purpose transport system within an 8000 ft^3 cell, the Demonstration Plant design utilizes seven systems in a 185,000 ft^3 cell. Efficiency and reliability are achieved by redundancy of transport devices that operate along two parallel fuel flow paths. Fuel storage and reactor closure maintenance are separated to facilitate hands-on maintenance. (auth)

29505 UNDER-SODIUM DIMENSIONAL GAUGING OF FERMI SUBASSEMBLIES. Matte, J. III (Atomic Power Development Associates, Inc., Detroit); Pugh, J. T. Conf. Remote Syst. Technol., Proc.; 20: 29-35(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

Measurements are being made of permanent bow of core subassemblies of the Enrico Fermi reactor following periods of operation at 200 MW(t). A method and suitable equipment were developed for making these measurements on high decay-heat subassemblies submerged under 10½ ft of reactor sodium. The

method employs a diving bell containing lights and a periscope to obtain a photograph of the subassembly handling head in a special gauge pot. The error in bow measurements thus obtained is < ±0.015 in. in magnitude and ±5 deg in direction. (auth)

29506 FAILED-FUEL TRANSFER SYSTEM FOR THE EBR-II. Divona, C. J. (Argonne National Lab., IL). Conf. Remote Syst. Technol., Proc.; 20: 36-45(1972).

From 20th remote systems technology conference; Idaho Falls, Idaho, USA (17 Sep 1972).

See CONF-720903-.

The Failed-Fuel Transfer System (FFTS) for the Experimental Breeder Reactor II permits: removal from the reactor of a subassembly containing a fuel-element cladding breach believed too severe for handling with the standard fuel-handling equipment; and transfer of the subassembly to the Hot Fuel Examination Facility (HFEF). The subassembly is removed from the reactor grid with the gripper of the standard fuel-handling equipment and is placed on the transfer arm, which is also standard. From there, the FFTS: retrieves the subassembly from the transfer arm; stores it during its decay cooling period; removes it from the primary tank of the reactor; and transfers it from the reactor building to the argon cell of the HFEF. The first two FFTS functions are performed by the "system's dipper/X-nozzle assembly," and the last two by the "radiation-shield/sealed-container assembly." (auth)

29507 NUMERICAL SOLUTION OF THE YAMANOUCHI MODEL FOR CORE SPRAY COOLING. Bukur, D. B.; Isbin, H. S. (Univ. of Minnesota, Minneapolis). Nucl. Eng. Des.; 23: No. 2, 195-197(1972).

The Yamanouchi model is used in the evaluation of the emergency spray system for a postulated loss-of-coolant accident for boiling water reactors. As originally proposed, Yamanouchi developed his model to predict the progressive rewetting of fuel rods exposed to spray cooling. The model has been adapted to the rewetting of the metal wall shroud which encloses the fuel rod bundle. Yamanouchi's analytical solution is valid only after a constant velocity front of the wetted surface is attained. The time necessary to establish the constant velocity front is examined. A model describing the transient motion of the water film on a metal surface was solved numerically employing the Crank-Nicolson implicit scheme. The results represent an extension of the Yamanouchi model and provide insight toward resolving more realistic cases. (auth)

Operation and Economics

29508 (WASH-1139-72) NUCLEAR POWER, 1973-2000. (Office of Planning and Analysis (AEC), Washington, DC). 1 Dec 1972. 43p. GPO $0.50.

A new forecast of the growth of nuclear power in the United States and the rest of the world prepared for use in AEC production planning and for other purposes is presented. Included are a revision and updating of the information presented in the AEC's 1971 forecast, WASH-1139 (Rev. 1), and an extension of the forecast through the year 2000. It represents the current evaluation of domestic and foreign growth trends in nuclear power, foreign enrichment capabilities in the future, the timing and application of plutonium recycle technology, the role of the High Temperature Gas-Cooled Reactor (HTGR), and the introduction of the Liquid Metal-Cooled Fast-Breeder Reactor (LMFBR). The nuclear generating capacities have been translated into demands for enrichment plant feed material, separative work, and other quantities based on the known and expected characteristics of nuclear reactors. (auth)

29509 INVESTIGATION OF THE EFFICIENCY ANALYSIS FOR ADVANCED NUCLEAR POWER REACTORS WITH HEAVY WATER AND VITROCERAMICAL FUEL. Haiduc, C.; Ionita, T. Stud. Cercet. Energ. Electroteh.; 22: No. 3, 559-569(1972). (In Rumanian).

A mathematical model and the results of an efficiency analysis for advanced nuclear power reactors with heavy water and vitroceramic fuel are presented. Results are also presented of the efficiency analysis and correction among different parameters for the nuclear fuels cycle for advanced nuclear power reactors with vitroceramic fuel. (tr-auth)

29510 FUEL BALANCE ACCOUNTANCY AND DEPRECIATION OF FUEL ELEMENTS OF NUCLEAR POWER PLANTS. Rusteberg, T. (Rheinisch-Westfaelisches Elektrizitaetswerk AG, Essen). Energiewirt. Tagesfragen; 22: No. 10, 497-499(1972). (In German).

A description is given of the cost accounting concerning reactor fuel elements broken down according to fixed costs and variable costs (depending on heat generation). A further subdivision is made to characterize the fuel elements according to their state: first-core fuel elements, fuel for charging, and reserve and spent fuel elements. (GF)

29511 PRESENT DEVELOPMENT AND POTENTIAL OF THERMAL BREEDERS. Zorzoli, G. B. (CISE, Milan). Energ. Nucl. (Milan); 20: No. 2, 88-96(Feb 1973). (In Italian).

An analysis of thermal breeders being developed shows a strong benefit in both economics and saving of natural resources if the Molten-Salt Breeder Reactor (MSBR) were adopted, while an economic penalty should be paid in the case of the Light Water Breeder Reactor (LWBR). The latter could become economically convenient if metallic fuel elements were used, but, as in the case of the MSBR, a strong opposition to the concept is to be expected from the industrial side. (auth)

Safety and Siting

29512 (IRS-F-13) REPORT IN THE FIELD OF REACTOR SAFETY ORDERED BY THE FEDERAL MINISTRY OF CONSTRUCTION AND SCIENCE. Quarterly Report, July 1-September 30, 1972. (Technischer Ueberwachungs-Verein E. V., Cologne (West Germany). Institut fuer Reaktorsicherheit). Dec 1972. 103p. (In German). Dep. NTIS (U. S. Sales Only).

Progress in continuing studies of the safety of and environmental risks associated with light water reactors is reported. Information is included on: excursions; safety equipment and methods; transient processes in the core and primary circuit; containment during loss-of-coolant accidents; core melting; protection of the environment during ordinary operation of the reactor and during extreme accident conditions; improvement of operating safety; and statistical methods for evaluating reactor safety. (LCL)

29513 RELIABILITY NUCLEAR POWER PLANTS. Specific Problems and Computation Methods. Nitu, V.; Gherasi, A.; Semedrea, M. Stud. Cercet. Energ. Electroteh.; 22: No. 3, 505-530(1972). (In Rumanian).

Nuclear power station reliability has been analysed from two standpoints for determining the availability of production capacities as well as the safety of the equipment and of the biological environment. The computation methods that have been used until now with regard to conventional thermal-power plants and which are based on the utilization of Markov chains were supplemented and adapted for the specific requirements of nuclear power, thus allowing for the solution of the more important problems set by safety requirements in the field of nuclear power plants. (tr-auth)

29514 BREEDER REACTORS. Design for Safety. Gilby, E. (United Kingdom Atomic Energy Authority, Risley, Eng.). New Sci.; 57: No. 834, 418-421(22 Feb 1973).

The two major safety requirements in fast breeder reactor design are provision for inserting neutron absorbing material to shut down the reactor and the provision of a system to remove decay heat. Various systems to achieve these requirements are discussed. By the year 2000 with 1000 reactors in operation it is suggested that the odds against a large accidental release in the world should be 100, or even 1000, to 1. It is considered that the problems involved are understood and good progress has been made in seeking solutions. To ensure the safety of fast reactors will entail the provision of engineering features designed, built, tested and maintained to achieve very high standards of reliability. Using the experience gained on prototype reactors it will be necessary to show that the problems of maintaining good local cooling in highly rated systems with a high heat density in the core can be overcome. Detection of any significant loss of local coolant must be utterly reliable. Although it is considered that a melt-down accident is preventable yet containment structures can provide a safeguard. (UK)

29515 ANALYSIS OF TRANSIENT FORCED CONVECTION LIQUID-METAL BOILING IN NARROW TUBES. Fauske, H. K.; Grolmes, M. A. (Argonne National Lab., IL). Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 64-71(1971).

Experiments and analysis indicate that transient liquid-metal boiling in fast reactor loss-of-flow accidents is best characterized by the "slug-annular" flow regime; the early void growth being described by the usual slug flow approximation (uniform pressure within the vapor bubble), while the annular flow condition (nonuniform pressure within the bubble) describes the later stages of voiding. The occurrence of flooding along the bubble can be used to estimate the transition from slug to annular flow. Simple methods for estimating the incipient superheat and the liquid-film thickness in the slug flow region as well as void fraction variation and two-phase pressure drop in the annular flow region are recommended. (auth)

29516 PWR FULL LENGTH EMERGENCY COOLING HEAT TRANSFER (FLECHT). Cadek, F. F.; Cermak, J. O. (Westinghouse Nuclear Energy Systems, Pittsburgh). Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 27-54(1971).

The objective of the PWR FLECHT (Full Length Emergency Cooling Heat Transfer) program was to obtain experimental reflooding heat transfer data under simulated loss-of-coolant accident conditions for evaluating the heat transfer capabilities of pressurized water reactor emergency core cooling systems. The major results of the entire PWR FLECHT program are summarized. The test results have verified the basic assumptions used in current reactor loss-of-coolant accident analysis. In particular, the effectiveness of bottom flooding and the importance of liquid entrainment as a heat transfer mechanism have been demonstrated. (auth)

29517 NUCLEAR PLANT LICENSING. Slowly Diminishing Turmoil. Olds, F. C. Power Eng.; 77: No. 3, 45-51(Mar 1973).

Problems in the licensing process for nuclear power plants are discussed. Several opinions are presented regarding review, licensing, and hearing procedures. (JWR)

29518 ANALYTICAL MODEL OF THE TRANSIENT REACTOR CORE SPRAY COOLING PROCESS. Rogers, A. E.; Leonard, J. E. (General Electric Co., San Jose, CA). AT(10-1)-1230. Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 14-26(1971).

The key phenomena associated with the transient core spray cooling process are examined. An analytical model of the process is derived to predict reactor fuel rod temperatures following a postulated loss-of-coolant accident. The model predictions show excellent agreement with full-scale 49-rod bundle test results. The effectiveness of core spray as a boiling water reactor core standby cooling system is confirmed by applying the model to a reactor accident analysis. (auth)

29519 HEAT TRANSFER FROM ELECTRICALLY HEATED RODS DURING A SIMULATED LOSS-OF-COOLANT ACCIDENT. Lawson, C. G. (Oak Ridge National Lab., TN). Chem. Eng. Progr., Symp. Ser.; 67: No. 119, 1-13(1971).

The loss of primary coolant from a pressurized water reactor as a result of an instantaneous rupture of a main circulating line is called a LOCA and is perhaps the most serious accident in terms of radioactivity release from the fuel to the outer containment system that can be realistically postulated. Emergency Core Cooling Systems (ECCS) are provided to maintain continuity of energy removal from the reactor core following such an event. Paramount to the evaluation of the ECCS is knowledge of the fuel and fuel-clad temperatures at the end of the coolant loss period of 8 to 14 seconds. Heat-transfer data are not available for the conditions of heater power (heat flux) and of transient coolant pressure, velocity, and temperature comparable to the environment around a fuel-rod bundle during a loss-of-coolant transient. Appropriate transient heat-transfer data have been obtained with single Zircaloy clad heaters (0.5-in.-OD × 2-ft-long) and a seven-rod cluster in a closed cycle, circulating, 1500 psi pressurized, water loop at power levels of 17.5 kw/ft (450,000 Btu/hr.ft^2) with cooling water near 500°F inlet and 1500 psi during a 12-second depressurization and coolant loss. Flow regimes associated with bulk-nucleate boiling and with thin film surface evaporation are clearly discernible where the temperature difference and heat flux data are considered. The high heat-transfer coefficients were observed for times greater than the heat removal time constants of the heater rods and suggest that assumptions made in current calculations are conservative. (auth)

29520 EXPERIMENTAL VIBRATION TESTS AT NUCLEAR POWER PLANTS. Ibanez, P. (Univ. of California, Los Angeles); Matthiesen, R. B.; Miller, W. R.; Smith, C. B. Advan. Instrum.; 26: 626.1-626.10(1971).

From 26th annual ISA conference and test measurements; Chicago, Illinois, USA (4 Oct 1971).

See CONF-711003-(Pt.2).

Methods for vibration testing full scale nuclear power plants at force levels simulating strong motion earthquakes are described. Several types of excitation, including ambient vibrations, forced vibrations caused by structural vibrators, large initial displacements, and forced vibrations due to explosive blasts are used. Tests have been conducted on five reactors at UCLA, Oak Ridge, South Carolina, Michigan, and San Onofre, California. The results of these tests are being compared with mathematical models, and more recently, with seismic records. In any test program, the amount of instrumentation available is limited. The data which are recorded must be those which are necessary to define the dynamic response of the component or structure. Based on experience gained with tests on components ranging from fuel elements to containment buildings, considerations for effective placement of instrumentation are described. The explosive blast technique appears to have promise as a method for testing nuclear power plants. To realize the full potential of this method, improved instrumentations are required. System requirements which would be suitable for recording and processing data from blast tests are described. (auth)

29521 DIE WAHRHEIT UEBER DIE ATOMKRAFTWERKE. Gefahr und Verharmlosung Beim Bau Von Kernkfratwerken. (Truth About Nuclear Power Plants. Hazards and Their Belittling in the Construction of Nuclear Power Plants). Kollbrunner, C. F. Institut fuer Bauwissenschaftliche Forschung, Nr. 22. Zurich; Buchdruckerei und Verlag Leemann (1972). 102p.

The pamphlet is a supplement to the publication 21 from the Institute of Architectural Research. The contradictory opinions of both friends and foes of nuclear power plants are presented. 565 references. (tr-auth)

Steam and Power Conversion Systems

29522 HIGH-CAPACITY GENERATORS FOR NUCLEAR POWER PLANTS. Poljak, N. A. Arch. Energiewirt.; 26: No. 17, 849-856(1972). (In German).

As a consequence of the rather poor condition of the steam produced in nuclear power plants of the first generation, the steam turbines have to be run at a speed lower than that of steam turbines in fossil fueled power plants. Hence these turbines are coupled to four-pole generators with a rated speed of 1,800 or 1,500 revolutions per minute. The various tendencies in the development of two- and four-pole turbogenerators with a single capacity of 2,000 MW and more are reviewed. (GF)

29523 TRANSMISSION OF HEAT AND PRESSURE DROPS IN VAPOR GENERATORS HEATED BY THE CIRCULATION OF Na. Robin, M. G. (CEN de Saclay, Gif-sur-Yvette, France). Rev. Gen. Therm.; 11: No. 132, 1189-1208(Dec 1972). (In French).

A description of the Phenix steam generator is given. The solutions envisaged for the next French Na cooled power plant are presented. The laws concerning the transmission of heat from the Na to water are established together with the laws concerning the pressure drops occurring in straight tubes; these laws were tested during trials with a Phenix type vapor generator module, and the results seem to be favorable. (FR)

Commercial Power Reactors

Refer also to abstract 28275.

29524 (AAEC/LIB/Bib-364) CANDU-TYPE REACTORS. A Bibliography. McDonald, C. J. (Comp.). (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jul 1972. 63p. Dep. NTIS (U. S. Sales Only) $5.25.

Forty general references and 221 detailed references are arranged chronologically by year covering the period 1957-1972. Reference is made to abstracts in INIS and NSA and arrangement is alphabetical by author within each year. (AT)

29525 TIHANGE NUCLEAR POWER PLANT. Stievenart, P. (Compagnie Generale d'Entreprises Electriques et Industrielles, Brussels). Electricite; No. 153, 27-44(1972). (In French).

The following information on the Tihange power plant and of the work in progress is given: site, general characteristics of the installation, core of the reactor, primary circuits and auxiliaries, security arrangements, and planning of the work. (tr-auth)

29526 DOEL NUCLEAR POWER PLANT. Dozinel, P. (Societe de Traction et d'Electricite, Brussels). Electricite; No. 151, 27-46(1972). (In French).

The following information on the Doel power plant and of the work in progress is given: site, general characteristics of the installation, core of the reactor, primary circuits and auxiliaries, security arrangements, and planning of the work. (tr-auth)

29527 RECENT DEVELOPMENTS OF FRANCE'S NUCLEAR POWER PROGRAM. Fiorentini, P. Com. Naz. Energ. Nucl., Notiz.; 18: No. 11, 45-60(Nov 1972). (In Italian).

The present situation of nuclear power plants in France and forecasts of developments over the coming years are reviewed. Particular reference is made to the water-cooled nuclear plants under the current VI five-year Plan and the Phenix fast breeder reactor being completed at Marcoule, and to the Super Phenix. (auth)

29528 EFFECTS OF MATERIAL BEHAVIOR ON THE DEVELOPMENT OF FAST-REACTOR COMPONENTS. Sani, L. Com. Naz. Energ. Nucl., Notiz.; 18: No. 11, 27-31(Nov 1972). (In Italian).

29529 CHARACTERISTICS OF A NEW TYPE OF BWR REACTOR. Bray, A. P.; Rubio, A.; Imhoff, D. H. Energ. Nucl. (Paris); 14: No. 6, 415-423(Nov 1972). (In French).

A new reactor BWR/6 developed by the General Electric Co. is described. Particular attention is given to new components which were subjected to full scale tests: ejector pumps; vapor separators; dryers; control rod drives. Tests are being conducted to confirm the performance of the new fuel assembly under the effects of operation of the emergency core cooling system (ECCS). The BWR/6 reactor should operate in accordance with established licensing and safety regulations. (FR)

29530 NUCLEAR ESTABLISHMENT AT THE WATERSHED. Kenward, M. New Sci.; 57: No. 836, 539-541(8 Mar 1973).

Fast breeder reactors play a significant part in the nuclear programs of many countries. The next few years will see a build up of activity as new reactors come into operation. As well as doing away with the need for enrichment plants and removing one potential environmental hazard from the nuclear fuel cycle, the breeder reactor will greatly extend the energy that can be derived from known reserves. However there are some who think that a major nuclear accident is inevitable and that this will lead to a clampdown on further building. It is therefore stressed that the unique problems of the development and organization of atomic energy must be discussed openly and without prejudice. Some of these problems such as plutonium waste and theft of weapons-grade material are discussed. The governmental organizations of the industry in USA and UK are considered. The next generation of power stations after fission will be controlled thermonuclear fusion but it will be at least twenty years before the first fusion reactor produces electricity. (UK)

29531 TRENDS OF THE AMERICAN NUCLEAR INDUSTRY. Grenon, M. Rev. Fr. Energ.; 24: No. 248, 117-121(Dec 1972). (In French).

The orders for reactors placed in 1972 by the American nuclear industry are presented. In spite of the delays which have occurred in initiating construction projects and the increased costs involved, a power of 300,000 MW(e) is envisaged for 1985. Problems connected with reactor cooling safety systems (ECCS), the financing of programs, the selection of reactor sites, and the supplying of nuclear plants with enriched U are discussed. The licensing necessary for the construction and operation of nuclear installations has led to differences of opinion between industry and the USAEC. Radioactive waste management is mentioned. (FR)

29532 ENERGY SITUATION. Olds, F. C. (Technical Publishing Co., Barrington, IL). Nucl. Eng. Des.; 23: No. 2, 121-140(1972).

Considerations concerning putting nuclear power into the perspective of the world energy picture are presented. These considerations are mainly taken from the point of view of the United States energy situation. Energy requirements are predicted to double on the decade, but questions about supply are unanswered. (auth)

Physics and Core Engineering

29533 EXPERIMENTS ON CRITICAL ASSEMBLIES AND THEIR RELATION TO THOSE CARRIED OUT IN NUCLEAR POWER PLANTS. Komissarov, L. V.; Lunin, G. L. (Inst. for Atomic Energy, Moscow). Kernenergie; 15: No. 8, 253-258(Aug 1972). (In German).

Experimental works carried out in critical assemblies during preparation of the start-up procedure for the reactors of the first, second, and third blocks of the Novo-Voronezh nuclear power plant and the Rheinsberg nuclear power plant are briefly described. Arguments are given on the extent of these experiments in critical assemblies necessary for optimum layout of the core of new reactors with respect to start-up procedure and operation. (auth)

29534 DYNAMIC BEHAVIOR OF THE RHEINSBERG NUCLEAR POWER PLANT IN DIFFERENT OPERATION REGIMES DURING STRETCHOUT OF BURNUP. Ackermann, G. (Ingenieurhochschule, Zittau, Ger.). Kernenergie; 15: No. 8, 269-275(Aug 1972). (In German).

The dynamic behavior of the Rheinsberg nuclear power plant is described by use of reactivity coefficients for different regimes of operation during stretch-out of burnup as stepwise drop of power, operation in sliding pressure regime, or operation with constant pressure of steam generators and inoperative reactor control elements. Theoretical considerations have been confirmed by experiments carried out before 3rd and 4th recharges. Plant power proves to be controllable within certain limits even during stretch-out of burnup. Simple approximative relations are given which allow to estimate the occurring spike of temperature and the possible duration of burnup stretch-out for the case of stepwise drop of turbine power as well as of course of power drop during operation in sliding pressure regime. Power oscillations that have been detected experimentally emerge under certain conditions elucidated in detail. (auth)

29535 INVESTIGATING THE NEUTRON FIELDS IN THE REACTORS AT NOVOVORENEZH NUCLEAR POWER STATION. Golubev, L. I.; Lomakin, S. S. Therm. Eng. (USSR) (Engl. Transl.); 18: No. 10, 84-86(Oct 1971).

Translated from Teploenergetika; 18: No. 10, 57-59(Oct 1971).

The release of energy and the energy distribution over the reactor volume is determined by the nature of the thermal neutron field in the Novovoronezh Reactors 1 and 2. Information about the distribution of fast neutrons was also determined. (auth)

Control Elements, Systems, and Instrumentation

29536 PROCESS COMPUTER SYSTEM OF HIGH AVAILABILITY IN THE STADE NUCLEAR POWER PLANT. Hampp, G.; Hoehne, P.; Moschitz, G. (Siemens AG, Munich). Elektron. Rechenanlagen; 14: No. 6, 259-262(1972). (In German).

A double computer system comprising two model 305 process computers has been installed in the Stade Nuclear Power Plant. When the first computer breaks down the other takes over the important centralized processing of measurement data on which the station's availability depends. Reasons are given for the solution chosen, the system configuration is described, the processes following the breakdown of a computer and its subsequent rehabilitation are explained and the requisite system programs are provided. (GF)

29537 USE OF COMPUTERS IN PWR REACTOR CONTROL. Nicol, G. (Societe d'Etudes Techniques et d'Entreprises Generales-Transmissions-Automatique-Informatique, Boulogne, France). Tech. Mod.; 64: No. 9, 61-62(Sep 1972). (In French).

The part played by computer in the running of the Fessenheim and Tihange PWR reactors are reviewed: data acquisition, monitoring of temperatures, handling of running problems, in-core measurement processing. Other uses are envisaged. (FR)

Containment Systems, Shielding, Waste Processing, and Radiation Protection

29538 DESIGN OF THE VACUUM BUILDING FOR PICKERING GENERATING STATION. Carthew, C. W.; Knautz, F. A.; Chan, G. T. (Ontario Hydro, Toronto). Nucl. Eng. Des.; 23: No. 2, 198-208(1972).

The nuclear powered Pickering Generating Station located near a heavily populated area required a number of safety devices and systems to guard against possible contamination of the atmosphere. Towards this objective a negative pressure containment system incorporating a large concrete vacuum building was selected. The structure, under operating conditions, is required to maintain an internal pressure of 1.0 psia and may be subjected to various loading conditions including wind, earthquake and other dynamic forces which occur in the event of an accident. The analysis of the various component parts of the building, in particular the perimeter wall, is emphasized. Several unique features of the building and certain construction procedures adopted to ensure structural soundness are described. (auth)

Cooling Systems

Refer also to abstract 28301.

29539 REVIEW OF PERFORMANCE AND RESULTS OF PARTIAL REACTOR INSPECTION IN THE RHEINSBERG NUCLEAR POWER PLANT IN 1971. Schoenherr, A.; Steffen, W.; Pastor, D.; Meurer, M. (VEB Kernkraftwerke, Greifswald, Ger.). Kernenergie; 15: No. 8, 264-269(Aug 1972). (In German).

After 5 years' operation an inspection program of the pressure vessel materials including lid, pressure vessel installations, main circulation lines and other main components of the primary coolant loop was started in the Rheinsberg nuclear power plant. As the first stage of the program, partial reactor inspection was carried out during the 1971 period of refuelling. Extent of inspection, techniques of materials testing used, and results of inspection are presented. Special importance is attached to the explanation of preparing works, lapse of inspection, employment of personnel, radiation level near the main components, and exposure of different groups of personnel. Preliminary inferences which should be worth noting in erection of further nuclear power plants have been made from the results of this inspection. Finally, it is pointed out that the individual parts of the WWER-2 reactor were designed with a high margin of safety proved by

the results of the partial reactor inspection in the Rheinsberg nuclear power plant. (auth)

29540 NEWLY DEVELOPED CONTROL AND STOP VALVES. Grotloh, K. (Winterthur Engineering Works Div., Switzerland). Sulzer Tech. Rev.; No. Nuclex 72, 89-104(1972).

A survey of important new developments in control and stop valves is presented. The equipment described represents a sample from a very complex field. Attention is merited by the gate valves and medium-actuated valves for nuclear power plants, with their stringent requirements in the way of operational dependability. (auth)

29541 FEED AND CONDENSATE PUMPS IN NUCLEAR POWER STATIONS. Stuerzinger, C. Sulzer Tech. Rev.; No. Nuclex 72, 29-45(1972).

The present trend in nuclear power engineering is characterized by the predominance of the light water reactor in its two variants; the boiling water (BWR) and pressurized water reactors (PWR). Of the nuclear power stations now operational or under construction throughout the world, about 85% by output is represented by light water types. The problems of feed and condensate pumps in these systems are discussed. (auth)

Fuel Systems and Components

Refer also to abstracts 28187, 28189, 28190, 28292–28295, 28311, and 28315.

29542 (BMBW-FBK-72-1) INITIAL REACTOR CORE OF THE NUCLEAR POWER STATION, LINGEN. Deublein, O.; Fricke, W. (Zentralstelle fuer Atomkernenergie Dokumentation, Leopoldshafen (West Germany)). Mar 1972. 32p. (In German). INIS.

A concise description of the fuel element structure is presented. As usual, the fuel rods have been assembled into 6 × 6-bundles. A comparison of the specific load conditions of several reactors underscores the significance of the KWL-core as a connecting link between a small prototype and the advanced large-scale plants. The design of the fuel elements has been guided by conservative principles drawing on the experience with similar patterns of an already proven standard. The natural uranium, purchased in the USA, has been passed on for enrichment to the U. S. enrichment plant. The description of the fuel elements fabrication includes some particulars of the actual manufacturing process. A flow diagram demonstrates the complexity of apparatus for quality controls. Transportation of the fuel elements is relatively easy and involves no risks. Despite some trouble at the beginning of the fabrication, the fuel elements have been completed on schedule. (INIS)

29543 BUILDUP OF TRANSURANIUM ELEMENTS IN THE BK-50 REACTOR FUEL. Gabeskiriya, V. Ya.; Belokopygov, V. S.; Novikov, Yu. B.; Polyukhov, V. G.; Sarychev, V. M.; Simakin, G. A. G. A.; Chetverikov, A. P. At. Energ. (USSR); 34: No. 3, 159-162 (Mar 1973). (In Russian).

The decrease in the amount of ^{235}U and the buildup of plutonium, americium and curium isotopes have been measured as a function of burnup fraction in the BK-50 reactor fuel. It has been shown that for a burnup of 19 kg/t U the contribution of plutonium fission to total burnup reaches 39%. In this case, the proportion of heavy isotopes ^{240}Pu, ^{241}Pu and ^{242}Pu in the accumulated Pu amounts to 39%. (auth)

Auxiliary Systems, Protection Systems, and Engineered Safeguards

29544 POSITIONING DEVICE FOR FUEL AND BREEDER ASSEMBLIES IN THE SNR 300 SODIUM-COOLED FAST REACTOR. Hans, R.; Maxam, S. (Internationale Atomreaktorbau GmbH, Bensberg, Ger.). Siemens Rev.; 40: No. 1, 27-31(Jan 1973).

Before a fuel assembly is removed from the SNR 300 Reactor, it must be determined whether its axis is in alignment with the axis of the reshuffling device. Furthermore, if the assembly is to be reinserted at a later date, it must be able to be placed in the same position as earlier; this requires a knowledge of the angle at which the hexagonal assembly is fitted. The measuring array senses the magnitude and direction of the axial displacement as well as the azimuthal position and feeds a signal to the computer, which is used for positioning in polar or Cartesian coordinates. The positioning device (mode of operation, design) is described and the technical data are listed. (auth)

29545 MEASURES FOR REDUCING THE RELEASE OF RADIOACTIVITY FROM ATOMIC POWER PLANTS. Change of Radioactive Waste Disposal System. Kuwashima, K. (Kansai Electric Power Co. Inc., Osaka). Genshiryoky Kogyo; 18: No. 10, 33-37(Oct 1972). (In Japanese).

Waste disposal systems in pre-1970 PWR and BWR power plants are reviewed. Records on the release of radioactivity during 1968, 1969, and 1970 are listed for typical US BWR and PWR plants. Improvements in the systems developed in the USA since January 1971 are reviewed. The Mini-Release System of Ge and Environment Assurance System of Westinghouse are explained. Improvements in the systems developed in Japan are explained. The development of the rare-gas hold up system and its application to Tsuruga and Fukushima No. 1 BWR plants are described. Other improvement for BWR plants include the evaporation disposal system for floor drains. For the PWR plants, increase of evaporators and addition of desalinators are examined. Finally, future problems and trends of waste disposal systems are briefly discussed. (JA)

Operation and Economics

29546 (DOCKET-50003-162) INDIAN POINT STATION, UNIT 1. Inquiry report No. 50-3/72-17Q. (Directorate of Regulatory Operations (SEC), Newark, N. J. Region I). 2 Jan 1973. 2p. Dep. NTIS $3.00.

The failure of the turbine throttle valve circuitry to promptly initiate a control rod fast insertion following a failure in a secondary system line at the Indian Point Station, Unit 1 is described. The failure of a control rod to fully insert during scram time tests is also described. (JWR)

29547 (DOCKET-50003-163) INDIAN POINT STATION, UNIT 1. Boron Solidified in Addition Pump Lines. (Consolidated Edison Co. of New York, Inc., New York). 5 Apr 1973. 2p. Dep. NTIS $3.00.

29548 (DOCKET-50010-146) DRESDEN NUCLEAR POWER STATION, UNIT 1. Bypassing of Chambers on Incore 113. (Commonwealth Edison Co., Morris, Ill. (USA)). 9 Apr 1973. 5p. Dep. NTIS $3.00.

29549 (DOCKET-50016-185) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. Report for November 1972. (Power Reactor Development Co., Detroit, Mich.). 3 Apr 1973. 12p. (PRDC-EF-111). Dep. NTIS $3.00.

29550 (DOCKET-50016-186) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. Report for December 1972. (Power Reactor Development Co., Detroit, Mich.). 3 Apr 1973. 15p. (PRDC-EF-112). Dep. NTIS $3.00.

29551 (DOCKET-50029-237) YANKEE NUCLEAR POWER STATION. AO-73-1, Outer and Inner Doors Open Simultaneously. (Yankee Atomic Electric Co., Boston, Mass.). 2 Apr 1973. 2p. Dep. NTIS $3.00.

29552 (DOCKET-50029-238) YANKEE NUCLEAR POWER STATION. Ability to Operate Plant with Less-Than-Normal Personnel Complement. (Yankee Atomic Electric Co., Westboro, Mass.). 6 Apr 1973. 3p. Dep. NTIS $3.00.

29553 (DOCKET-50133-116) HUMBOLDT BAY POWER PLANT, UNIT 3. Technical Specifications, Change No. 44. (Directorate of Licensing (AEC), Washington, D. C.). Mar 1973. 13p. Dep. NTIS $3.00.

29554 (DOCKET-50146-114) SAXTON NUCLEAR EXPERIMENTAL REACTOR PROJECT. Request for Clarification of License Authority. (Saxton Nuclear Experimental Corp., PA). 20 Oct 1972. 1p. Dep. NTIS $3.00.

29555 (DOCKET-50155-144) BIG ROCK POINT NUCLEAR PLANT. Technical Specifications, Change No. 35. (Directorate of Licensing (AEC), Washington, D. C.). 2 Mar 1973. 3p. Dep. NTIS $3.00.

Revised technical specifications are presented concerning the use of replacement auxiliary antimony–beryllium neutron sources in the core. (DCC)

29556 (DOCKET-50155-146) BIG ROCK POINT NUCLEAR PLANT. Failure of Main Stream Isolation Valve to Close. (Consumers Power Co., Jackson, Mich.). 5 Apr 1973. 2p. Dep. NTIS $3.00.

29557 (DOCKET-50171-117) PEACH BOTTOM ATOMIC POWER STATION, UNIT 1. Inquiry Report 50-171/72-080. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 21 Dec 1972. 1p. Dep. NTIS $3.00.

Information is presented concerning an excessive scram time for control rod 3c. (DCC)

29558 (DOCKET-50206-193) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Inspection on July 10–14, 1972.

(Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 9 Aug 1972. 2p. Dep. NTIS $3.00.

29559 (DOCKET-50206-194) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Inquiry report No. 050-0206/73-01Q. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 10 Jan 1973. 2p. Dep. NTIS $3.00.
Information is presented concerning a tube leak in the "A" steam generator. (DCC)

29560 (DOCKET-50213-186) HADDAM NECK PLANT, UNIT 1. AO-73-3, Unsatisfactory Monthly Test of Emergency Diesel Generator. (Connecticut Yankee Atomic Power Co., East Hampton (USA)). 4 Apr 1973. 1p. Dep. NTIS $3.00.

29561 (DOCKET-50219-245) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Recirculation Loop Started When Its Temperature and Reactor Coolant Temperature Exceeded 50°F Differential. (Jersey Central Power and Light Co., Morristown, NJ). 23 Mar 1973. 3p. Dep. NTIS $3.00.

29562 (DOCKET-50219-246) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Circuit Modifications. (Jersey Central Power and Light Co., Morristown, NJ). 29 Mar 1973. 2p. Dep. NTIS $3.00.
Modifications are described for control circuits for the reactor building ventilation system and the liquid poison pumps. (DCC)

29563 (DOCKET-50219-247) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Inquiry Report 73-05Q. (Directorate of Regulatory Operations (AEC), Newark, NJ. Region I). 4 Apr 1973. 2p. Dep. NTIS $3.00.
Information is presented concerning an increase in stack release rate following completion of a main steam isolation valve test. (DCC)

29564 (DOCKET-50219-248) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Inquiry report No. 50-219/72-32Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 15 Dec 1972. 2p. Dep. NTIS $3.00.
The failure of a pipe in the recirculation line of the floor drain sample tank is reported. (JWR)

29565 (DOCKET-50219-249) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Inquiry Report No. 50-219/73-04Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 15 Mar 1973. 4p. Dep. NTIS $3.00.
Information regarding the use of incorrect procedures for restarting the B recirculation loop at the Oyster Creek Power Plant, Unit 1 is presented. (JWR)

29566 (DOCKET-50220-128) NINE MILE POINT NUCLEAR STATION, UNIT 1. Inquiry Report 73-01Q. (Directorate of Regulatory Operations (AEC), Newark, NJ. Region I). 5 Apr 1973. 2p. Dep. NTIS $3.00.
Information is presented concerning technical specifications for inoperable control rod drives. (DCC)

29567 (DOCKET-50220-130) NINE MILE POINT NUCLEAR STATION, UNIT 1. Inquiry Report No. 50-220/72-10Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 29 Sep 1972. 2p. Dep. NTIS $3.00.
Information on the failure of a Limitorque valve operator in the recirculation pump suction line is presented. (JWR)

29568 (DOCKET-50220-131) NINE MILE POINT NUCLEAR STATION, UNIT 1. Technical Specifications, Request for Temporary Relief. (Niagara Mohawk Power Corp., Syracuse, N. Y.). 4 Apr 1973. 3p. Dep. NTIS $3.00.

29569 (DOCKET-50237-313) DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3. Radwaste Waste Surge Tank Found to Contain 5.6 Curies. (Commonwealth Edison Co., Chicago, Ill.). 29 Mar 1973. 2p. (DOCKET-50249-205). Dep. NTIS $3.00.

29570 (DOCKET-50237-314). DRESDEN NUCLEAR POWER STATION, UNIT 2. High Activity Water in Waste Surge Tank. (Commonwealth Edison Co., Morris, Ill. (USA)). 5 Apr 1973. 1p. Dep. NTIS $3.00.

29571 (DOCKET-50237-315) DRESDEN NUCLEAR POWER STATION, UNIT 2. Explosion Took Place in a Temporary Filter. (Commonwealth Edison Co., Chicago, Ill.). 5 Apr 1973. 5p. Dep. NTIS $3.00.

29572 (DOCKET-50245-204) MILLSTONE NUCLEAR POWER STATION, UNIT 1. AO-73-3, "A" Condensate Booster Pump Inboard Bearing Failed. (Millstone Point Co., Hartford, Conn.). 27 Mar 1973. 1p. Dep. NTIS $3.00.

29573 (DOCKET-50245-206) MILLSTONE NUCLEAR POWER STATION, UNIT 1. AO-73-4 and AO-73-5, Reactor Pressure Momentarily Reached 1042 psig and Failure of Gas Turbine to Start. (Millstone Point Co., Hartford, Conn.). 6 Apr 1973. 3p. Dep. NTIS $3.00.

29574 (DOCKET-50245-208) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Inquiry Report No. 50-245/73-01Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 11 Jan 1973. 2p. Dep. NTIS $3.00.
Information is presented concerning leaks in the control rod drive system hydraulic accumulators. (DCC)

29575 (DOCKET-50245-210) MILLSTONE NUCLEAR POWER STATION, UNIT 1. AO-73-1, Additional Investigation on Two Control Rods. (Millstone Point Co., Hartford, Conn.). 4 Apr 1973. 2p. Dep. NTIS $3.00.

29576 (DOCKET-50249-209) DRESDEN NUCLEAR POWER STATION, UNIT 3. Nine of 16 Main Steam Line High Temperature Sensors Out of Calibration. (Commonwealth Edison Co., Chicago, Ill.). 4 Apr 1973. 2p. Dep. NTIS $3.00.

29577 (DOCKET-50250-121) TURKEY POINT PLANT, UNITS 3 AND 4. AO-3-72-8, Battery Charger Transformer Winding Insulation Caught Fire. (Florida Power and Light Co.). 16 Dec 1972. 2p. (Docket-50251-101). Dep. NTIS $3.00.

29578 (DOCKET-50251-105) TURKEY POINT PLANT, UNIT 4. Facility Operating License DPR-41; Appendix B, Environmental Technical Specifications; Notice of Issuance of Facility Operating License. (Directorate of Licensing (AEC), Washington, DC). 10 Apr 1973. 32p. Dep. NTIS $3.75.

29579 (DOCKET-50254-180) QUAD-CITIES STATION, UNITS 1 AND 2. Core Spray Pump Failed to Operate Properly. (Commonwealth Edison Co., Cordova, Ill.). 21 Oct 1972. 1p. (DOCKET-50265-171). Dep. NTIS $3.00.

29580 (DOCKET-50254-182) QUAD-CITIES STATION, UNIT 1. Limit Switch Inoperable. (Commonwealth Edison Co., Cordova, Ill.). 3 Feb 1973. 1p. Dep. NTIS $3.00.

29581 (DOCKET-50254-184) QUAD-CITIES STATION, UNITS 1 AND 2. Unplanned Release of Radioactive Liquid Waste. (Commonwealth Edison Co., Cordova, Ill.). Apr 1973. 2p. (Docket-50265-174). Dep. NTIS $3.00.

29582 (DOCKET-50263-194) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. Technical Specifications, Change 5. (Directorate of Licensing (AEC), Washington, D. C.). 2 Mar 1973. 13p. Dep. NTIS $3.00.
Revised technical specifications are presented concerning maintenance procedures and operations aspects. (DCC)

29583 (DOCKET-50271-160) VERMONT YANKEE NUCLEAR POWER STATION. Inquiry Report No. 50-271/73-01Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 13 Feb 1973. 2p. Dep. NTIS $3.00.
Information is presented concerning failed fuel elements. (DCC)

29584 (DOCKET-50271-164) VERMONT YANKEE NUCLEAR POWER STATION. Operation Report No. 73-01, January 1973. (Vermont Yankee Nuclear Power Corp., Rutland). 2 Apr 1973. 26p. Dep. NTIS $3.50.

29585 (DOCKET-50271-165) VERMONT YANKEE NUCLEAR POWER STATION. Operation Report No. 73-02, February 1973. (Vermont Yankee Nuclear Power Corp., Rutland). 2 Apr 1973. 27p. Dep. NTIS $3.00.

29586 (DOCKET-50271-167) VERMONT YANKEE NUCLEAR POWER STATION. Operation of Plant with Less-than-Normal Personnel Complement. (Vermont Yankee Nuclear Power Corp., Rutland). 6 Apr 1973. 2p. Dep. NTIS $3.00.

29587 (DOCKET-50277-79) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. Action to be TAKEN TO CORRECT ITEMS OF NONCOMPLIANCE BROUGHT TO ATTENTION FOLLOWING RECENT INSPECTION. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 13 Nov 1972. 2p. (DOCKET-50278-76). Dep. NTIS $3.00.

29588 (DOCKET-50280-116) SURRY POWER STATION, UNIT 1. Report No. USRE-S1-72-01, Unusual Safety Related Event. (Virginia Electric and Power Co., Richmond). 23 Mar 1973. 8p. Dep. NTIS $3.00.
The generation of an F_q peaking factor during zero power physics testing at the Surry Power Station, Unit 1 which was 45% higher than predicted in the Final Safety Analysis Report is reported. Rod insertion limits were modified to limit potential ejected rod worth. (JWR)

29589 (DOCKET-50280-118) SURRY POWER STATION, UNIT 1. Inspection Report No. 50-280/72-13. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 15 Nov 1972. 9p. Dep. NTIS $3.00.

29590 (DOCKET-50280-120) SURRY POWER STATION, UNIT 1. AO-S1-73-03, Loss of Rod Position Indication. (Virginia Electric and Power Co., Richmond). 9 Apr 1973. 7p. Dep. NTIS $3.00.

29591 (DOCKET-50293-128) PILGRIM NUCLEAR POWER STATION. AO-73-10, Barton Model 288 Differential Pressure Indicating Switch. (Boston Edison Co., Mass.). 26 Mar 1973. 1p. Dep. NTIS $3.00.

The failure of a Barton Model 288 differential pressure indicating switch for the low pressure coolant injection system is described. (DCC)

29592 (DOCKET-50293-129) PILGRIM NUCLEAR POWER STATION. AO-73-11, Condenser Low Vacuum Switch Failed and Main Stack Process Monitoring System Leaked. (Boston Edison Co., Mass.). 9 Apr 1973. 4p. Dep NTIS $3.00.

29593 (DOCKET-50295-93) ZION STATION NUCLEAR POWER PLANT, UNIT 1. Inquiry Report No. 050-295/73-01Q. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 11 Jan 1973. 2p. Dep. NTIS $3.00.

Information is presented concerning the failure of the emergency diesel generator. (DCC)

29594 (DOCKET-50309-99) MAINE YANKEE ATOMIC POWER STATION. Inoperative High Pressure Safety Injection Pump. (Maine Yankee Atomic Power Co., Wiscasset). 4 Dec 1972. 1p. Dep. NTIS $3.00.

29595 (DOCKET-50309-100) MAINE YANKEE ATOMIC POWER STATION. Low Safety Injection Tank Gas Pressure. (Maine Yankee Atomic Power Co., Wiscasset). 11 Dec 1972. 1p. Dep. NTIS $3.00.

29596 (DOCKET-50309-101) MAINE YANKEE ATOMIC POWER STATION. AO-73-1, Charging Pump Suction Valves Failed to Operate Properly Due to Icing. (Maine Yankee Atomic Power Co., Wiscasset). 7 Feb 1973. 2p. Dep. NTIS $3.00.

29597 (DOCKET-50309-102) MAINE YANKEE ATOMIC POWER STATION. Inquiry Report No. 50-309/73-01Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 27 Feb 1973. 2p. Dep. NTIS $3.00.

The failure of steam line turning vanes in the Maine Yankee Power Station is reported. (JWR)

29598 (DOCKET-50309-103) MAINE YANKEE ATOMIC POWER STATION. Operation Report 2-73, February 1973. (Maine Yankee Atomic Power Co., Westboro, Mass.). 2 Apr 1973. 26p. Dep. NTIS $3.50.

29599 (DOCKET-50309-104) MAINE YANKEE ATOMIC POWER STATION. Operation of Plant with Less-Than-Normal Personnel Complement. (Maine Yankee Atomic Power Co., Westboro, Mass.). 6 Apr 1973. 2p. Dep. NTIS $3.00.

29600 FUTURE OF ELECTRICITY OF NUCLEAR ORIGIN IN THE EUROPEAN COMMUNITY. Scalliet, R.; Charrault, J. C. (EURATOM, Brussels). Rev. Fr. Energ.; 24: No. 248, 91-95 (Dec 1972). (In French).

The difficulties which could impede the development of nuclear electricity are examined. The necessary conditions for maximizing the chances of success of the 2nd Indicative Nuclear Program (the freeing of closed markets, normalization, concentration of the electromechanical and nuclear industry, investments, guaranteed and stable supplies of nuclear fuels, the informing of the public in the various Common Market countries) are defined. The future of the nuclear industry is linked to the creation of multinational groups. It is necessary to normalize the safety criteria upon which the authorization for the construction and exploitation of nuclear installations depend. (FR)

29601 PROGRESS OF POWER PLANTS TO DATE. At. Jap.; 16: No. 7, 37-43(Jul 1972).

The state of operation or construction of nuclear power plants in Japan from May to July 1972 is given. The reactors are mostly BWRs and PWRs except for one GCR. The Tokai GCR, Tsuruga, Fukushima-1, -2, -3, -4, and -5, second Fukushima-1, Mihama-1 and -2, Takahama-1 and -2, Hamaoka, Shimane, Genkai-1, Joyo, and Fugen are covered. For those already in operation, cumulative power outputs, load factors, availability, burn-up, failure, etc. are listed. For those under construction or with applications pending the stage of the construction at present and the installation permit are outlined. (JA)

29602 OPERATIONAL BEHAVIOR OF SELECTED MAIN EQUIPMENTS OF THE RHEINSBERG NUCLEAR POWER PLANT. Oehmigen, A.; Brune, W.; Hahn, K.; Heinemann, W.; Schindler, D. (VEB Kernkraftwerke, Greifswald, Ger.). Kernenergie; 15: No. 8, 258-263(Aug 1972). (In German).

Most important experiences gained with operation of the reactor, main circulating pumps, steam generators, and the turbine generator during the past 5.5 y of operation of the Rheinsberg nuclear power plant are described. In particular, problems of the reactor control and safety system as well as extensive erosion phenomena observed in the high pressure stage of the turbine generator are dealt with. (auth)

29603 OPTIMIZATION OF CAMPAIGN DURATION FOR A PERIODIC REGIME OF RELOADING IN THE RHEINSBERG NUCLEAR POWER PLANT. Moeller, W. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 15: No. 8, 276-280(Aug 1972). (In German).

The campaign in a periodic regime of refueling has been optimized by variation of initial ^{235}U enrichment and fraction of freshly loaded fuel with respect to minimum cost of power generation. Burnup states of the Rheinsberg reactor were calculated up to the 8th campaign for two different regimes of reloading. (auth)

29604 PEACEFUL USE OF NUCLEAR ENERGY. Draft of the 4th Atomic Program Finished. Inform. Bild. Wiss.; No. 11, 149-150(1972). (In German).

A short survey is given of the main activities promoted by the German Federal Government for the next 4 years: reactor development (THTR, SNR-300, nuclear container ship), fuel cycle (uranium enrichment, reprocessing and waste disposal) and application of radioisotopes. The sum total for the tasks of long-range energy supply, environmental research and basic structures, is about 6.5 billion German Marks. (GF)

29605 FUEL CYCLE FOR ATOMIC POWER PLANTS. Nakamura, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Karyoku Hatsuden; 23: No. 8, 825-837(Aug 1972). (In Japanese).

The intrinsic difference of fuel problems between fossil and atomic power plants is discussed on the following points. (1) Production and consumption of fuel simultaneously take place in atomic power plants. (2) Incompatibility of fuel to atomic reactors. (3) Importance of cost and the fabrication of nuclear fuel. (4) Design improvement of nuclear fuel elements. (5) User's responsibility for affecting national economy. The fuel cycle of light water reactors is reviewed. Cost analysis for mining, milling, conversion, enrichment, reconversion, fabrication and reprocessing is also given. The fuel cycle costs of 1000 MW(e) PWR and BWR power plants in 1980 is estimated and discussed for three typical types of the fuel cycle; once through, recycle of depleted uranium and Pu credit, and recycle of both Pu and depleted uranium. Results of the fuel cycle cost analysis performed for 6 other types of recycle are also summarized. From the viewpoint of uranium resources, the recycle of depleted uranium saves 20% in comparison with the once through cycle. Whereas the plutonium recycle saves 13%, and the recycle of both uranium and plutonium saves 33%. The importance of developing techniques of plutonium recycling is also described. (JA)

29606 PROGRAMMED PLANNING OF POWER PLANTS. Investigations with Regard to Operating Reliability and Safety. Ditterich, K. (Joint Nuclear Research Center, Ispra, Italy). Elektrotech. Z., 24B: No. 18, 461-463(1972). (In German).

It is shown how the design of conventional and nuclear power plants (in the latter case especially with regard to safety) can be systematically automated and rationalized by means of modern methods of operations research and suitable computer models. (GF)

Safety and Siting

Refer also to abstract 29844.

29607 (DOCKET-50003-161) INDIAN POINT STATION, UNIT 1. Petition for Full Term Operating License, Amendment 4. (Consolidated Edison Co. of New York, Inc., New York). 30 Mar 1973. 82p. Dep. NTIS $6.25.

Requested information is presented concerning the containment structure, radioactive waste disposal system, radioactive effluents, fuel storage facility, steam generator, instrumentation, and cooling system. (DCC)

29608 (DOCKET-50003-164) INDIAN POINT STATION, UNIT 1. Meteorology in the Environs of Plant. (Consolidated Edison Co. of New York, Inc., New York). 9 Apr 1973. 13p. Dep. NTIS $3.00.

29609 (DOCKET-50010-145) DRESDEN NUCLEAR POWER STATION, UNIT 1. Response to Request for Hydrogen Mixing and Monitoring Equipment. (Commonwealth Edison Co., Chicago, Ill.). 5 Apr 1973. 2p. Dep. NTIS $3.00.

29610 (DOCKET-50029-236) YANKEE NUCLEAR POWER STATION. Technical Specifications, Change 106 Authorized. (Directorate of Licensing (AEC), Washington, D. C.). 30 Mar 1973. 8p. Dep. NTIS $3.00.

Revised technical specifications are presented concerning the use of new control rod shroud tube assemblies. (DCC)

29611 (DOCKET-50130-17) PATHFINDER GENERATING PLANT. License Termination Order. (Directorate of Licensing (AEC), Washington, D.C.). 5 Mar 1973. 4p. Dep. NTIS $3.00.

29612 (DOCKET-50133-117) HUMBOLDT BAY POWER PLANT, UNIT 3. Technical Specifications, Proposed Change 37, Request for Withdrawal. (Pacific Gas and Electric Co., San Francisco, Calif.). 11 Jan 1973. 1p. Dep. NTIS $3.00.

The request for automatic vent valve initiation circuitry modifications is withdrawn. (DCC)

29613 (DOCKET-50155-145) BIG ROCK POINT NUCLEAR PLANT, Emergency Core Cooling System, Request for Delay in Submittal. (Consumers Power Co., Jackson, Mich.). 27 Jun 1972. 1p. Dep. NTIS $3.00.

29614 (DOCKET-50213-185) HADDAM NECK PLANT, UNIT 1. Safety Review Schedule and Environmental Review Schedule. (Directorate of Licensing (AEC), Washington, D. C.). 29 Mar 1973. 3p. Dep. NTIS $3.00.

29615 (DOCKET-50220-132) NINE MILE POINT NUCLEAR STATION, UNIT 1. Removal of Baffling from Within the Torus. (Niagara Mohawk Power Corp., Syracuse, N. Y.). 6 Apr 1973. 18p. Dep. NTIS $3.00.

29616 (DOCKET-50245-202) MILLSTONE NUCLEAR POWER STATION, UNIT 1. State of Connecticut to Conduct Program of Effluent and Environmental Monitoring. (Directorate of Licensing (AEC), Washington, D. C.). 27 Feb 1973. 2p. Dep. NTIS $3.00.

29617 (DOCKET-50245-203) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Technical Specifications, Change No. 11. (Directorate of Licensing (AEC), Washington, DC). 2 Mar 1973. 11p. Dep. NTIS $3.00.

29618 (DOCKET-50245-205) MILLSTONE NUCLEAR POWER STATION, UNITS 1 AND 2. Draft Environmental Statement, Replies to Request. (Millstone Point Co., Hartford, Conn.). 3 Apr 1973. 12p. (Docket-50336-52). Dep. NTIS $3.00.

29619 (DOCKET-50245-207) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Inquiry Report No. 50-245/72-27Q. (Directorate of Regulatory Operations (AEC), Newark, NJ Region I). 10 Nov 1972. 2p. Dep. NTIS $3.00.

Information on a change in technical specifications for the standby liquid control system is presented. (JWR)

29620 (DOCKET-50245-209) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Comparison of Monticello and Millstone Peak Clad Temperatures. (Millstone Point Co., Hartford, Conn.). 2 Apr 1973. 1p. Dep. NTIS $3.00.

29621 (DOCKET-50247-98) INDIAN POINT NUCLEAR GENERATING UNIT 2. Fuel Densification, Addendum. (Consolidated Edison Co. of New York, Inc., New York). 30 Mar 1973. 11p. Dep. NTIS $3.00.

29622 (DOCKET-50249-206) DRESDEN NUCLEAR POWER STATION, UNIT 3. Negative Certification Requirement of Section 401 of Federal Water Pollution Control Act Amendments of 1972. (Commonwealth Edison Co., Chicago, Ill.). 27 Mar 1973. 4p. Dep. NTIS $3.00.

29623 (DOCKET-50249-208) DRESDEN NUCLEAR POWER STATION, UNIT 3. Summary Technical Report of Secondary Containment Leak Rate Tests. (Commonwealth Edison Co., Chicago, Ill.). 6 Apr 1973. 4p. Dep. NTIS $3.00.

29624 (DOCKET-50250-118) TURKEY POINT PLANT, UNIT 3. Technical Specifications, Change 4. (Directorate of Licensing (AEC), Washington, DC). 3 Apr 1973. 1p. Dep. NTIS $3.00.

29625 (DOCKET-50250-120) TURKEY POINT PLANT, UNIT 3. Inspection Report 73-1. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). Apr 1973. 26p. Dep. NTIS $3.25.

29626 (DOCKET-50250-123) TURKEY POINT PLANT, UNITS 3 AND 4. Thin Wall Valves. (Florida Power and Light Co.). 10 Apr 1973. 5p. (DOCKET-50251-103). Dep. NTIS $3.00.

29627 (DOCKET-50250-124) TURKEY POINT PLANT, UNITS 3 AND 4. Technical Specifications. (Florida Power and Light Co.). 10 Apr 1973. 214p. (DOCKET-50251-104). Dep. NTIS $12.75.

29628 (DOCKET-50251-100) TURKEY POINT PLANT, UNIT 4. Test Scheduled after Loading but Prior to Criticality. (Florida Power and Light Co.). 3 Apr 1973. 2p. Dep. NTIS $3.00.

29629 (DOCKET-50254-181) QUAD-CITIES STATION, UNITS 1 AND 2. Inspection Reports Nos. 050-254/72-10 and 050-265/72-10. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 17 Jan 1973. 34p. (DOCKET-50265-172). Dep. NTIS $3.75.

Additional information on the release of radioactive effluents from the Quad-Cities Station, Units 1 and 2 is presented. (JWR)

29630 (DOCKET-50259-81) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2 AND 3. Emergency Electric Power Systems and Effects of Failures in Non-Class I Equipment. (Tennessee Valley Authority, Chattanooga). 24 Aug 1973. 3p. (DOCKET-50260-75; DOCKET-50296-73). Dep. NTIS $3.00.

29631 (DOCKET-50259-82) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Emergency Electric Report, Amendment 49. (Tennessee Valley Authority, Chattanooga). 2 Apr 1973. 112p. (DOCKET-50260-76; DOCKET-50296-74). Dep. NTIS $7.75.

Requested additional information on the consequences of postulated pipe failures outside the containment at the Browns Ferry Nuclear Power Station, Units 1, 2, and 3, is presented. (JWR)

29632 (DOCKET-50259-83) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Sequoyah Nuclear Plant, Units 1 and 2. Watts Bar Nuclear Plant, Units 1 and 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 52p. (DOCKET-50260-77; DOCKET-50296-75; DOCKET-50327-36; DOCKET-50328-34; DOCKET-50390-36; DOCKET-50391-36). Dep. NTIS $4.75.

29633 (DOCKET-50259-84) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Inspection Report No. 50-259/73-1. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 16p. Dep. NTIS $3.00.

29634 (DOCKET-50259-85) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Inspection Report No. 50-259/73-2. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 10 Apr 1973. 27p. Dep. NTIS $3.50.

29635 (DOCKET-50259-86) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Control of Gases Resulting from a Postulated Loss-of-Coolant Accident. (Tennessee Valley Authority, Chattanooga). 14 Apr 1973. 1p. (DOCKET-50260-78; DOCKET-50296-76). Dep. NTIS $3.00.

29636 (DOCKET-50261-161) H. B. ROBINSON UNIT 2. THIN WALL VALVES. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 10p. Dep. NTIS $3.00.

29637 (DOCKET-50263-196) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. Reply to Request for Information on Managerial and Administrative Controls for Operation. (Northern States Power Co., Minneapolis, Minn.). 6 Apr 1973. 4p. Dep. NTIS $3.00.

29638 (DOCKET-50269-97) OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3. Comments on Letter of December 15, 1972. (Duke Power Co., Charlotte, NC). 4 Apr 1973. 3p. (DOCKET-50270-79; DOCKET-50287-71). Dep. NTIS $3.00.

Proposed changes in the technical specifications for operation of the Oconee Nuclear Station, Units 1, 2, and 3 are discussed. (JWR)

29639 (DOCKET-50270-80) OCONEE NUCLEAR STATION, UNITS 2 AND 3. Supplemental Environmental Report, Revision 2. (Duke Power Co., Charlotte, N. C.). 30 Mar 1973. 11p. (Docket-50287-72) Dep. NTIS $3.00.

29640 (DOCKET-50270-81) OCONEE NUCLEAR STATION, UNITS 2 AND 3. Steps Taken with Respect to Items of Apparent Noncompliance Brought to Attention Following Inspection, October 3-6, 1972. (Directorate of Regulatory Operations (AEC),

Atlanta, Ga. (USA). Region II). 1 Dec 1972. 30p. (DOCKET-50287-73). Dep. NTIS $3.50.

Requested information on the quality assurance program for the construction of the Oconee Nuclear Station, Units 2 and 3 is presented. (JWR)

29641 (DOCKET-50271-159) VERMONT YANKEE NUCLEAR POWER STATION. Inspection Report 72-16. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 1 Feb 1973. 8p. Dep. NTIS $3.00.

29642 (DOCKET-50271-161) VERMONT YANKEE NUCLEAR POWER STATION. Inspection Report 73-4. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 8 Mar 1973. 6p. Dep. NTIS $3.00.

29643 (DOCKET-50271-162) VERMONT YANKEE NUCLEAR POWER STATION. Proposed Change 8 (Suppl. 2) Revised Drawing of Interim Offgas System Piping and Instrumentation Drawing. (Vermont Yankee Nuclear Power Corp., Rutland). 4 Apr 1973. 3p. Dep. NTIS $3.00.

29644 (DOCKET-50271-163) VERMONT YANKEE NUCLEAR POWER STATION. Proposed Change to Technical Specifications of March 19, 1973 Denied. (Directorate of Licensing (AEC), Washington, DC). 5 Apr 1973. 4p. Dep. NTIS $3.00.

29645 (DOCKET-50271-166) VERMONT YANKEE NUCLEAR POWER STATION. Devices to Prevent Accidental Dropping of Fuel Casks. (Vermont Yankee Nuclear Power Corp., Rutland). 5 Apr 1973. 4p. Dep. NTIS $3.00.

29646 (DOCKET-50271-168) VERMONT YANKEE NUCLEAR POWER STATION. Technical Specifications, Change 6. (Directorate of Licensing (AEC), Washington, DC). 11 Apr 1973. 5p. Dep. NTIS $3.00.

29647 (DOCKET-50272-54) SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2. Commentary on Structural Adequacy. (Newmark (Nathan M.), Urbana, Ill). 20 Mar 1973. 8p. (Docket-50311-55). Dep. NTIS $3.00.

29648 (DOCKET-50272-57) SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2. Final Environmental Statement. (Public Service Electric and Gas Co., Newark, N. J.). Apr 1973. 270p. (DOCKET-50311-57). Dep. NTIS $15.50.

The environmental effects of construction and operation of the Salem Power Reactor Units 1 and 2 are examined. The descriptions include: the environment in the area, including the history, geography, geology, hydrology, climatology, ecology, land and water use including chemical characteristics; the facility and its effluents; the impacts from construction and operation of the facility; alternatives to the proposed action; irreversible and irretrievable long-term commitments of resources from plant operation; need for power; and the benefits-cost analysis of the proposed plant operation. (DCC)

29649 (DOCKET-50275-35) DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2. Inspection Report 73-02. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 4 Apr 1973. 7p. Dep. NTIS $3.00.

29650 (DOCKET-50275-37) DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2. Blowdown Treatment System. (Pacific Gas and Electric Co., San Francisco, Calif.). 6 Apr 1973. 17p. (DOCKET-50323-34). Dep. NTIS $3.00.

29651 (DOCKET-50275-38) DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2. Draft Environmental Statement, Comments of Federal Power Commission. (Federal Power Commission, Washington, D. C. (USA)). 11 Apr 1973. 8p. (DOCKET-50323-35). Dep. NTIS $3.00.

29652 (DOCKET-50277-80) PEACH BOTTOM ATOMIC POWER STATION, UNIT 2. Inspection Report No. 50-277/72-07. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 1 Nov 1972. 10p. Dep. NTIS $3.00.

29653 (DOCKET-50277-81) PEACH BOTTOM ATOMIC POWER STATION, UNIT 2. Inspection Report No. 50-277/72-10. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 24 Nov 1972. 14p. Dep. NTIS $3.00.

29654 (DOCKET-50277-82) PEACH BOTTOM ATOMIC POWER STATION, UNIT 2. Inspection Report, No. 50-277/72-09. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 18 Dec 1972. 12p. Dep. NTIS $3.00.

29655 (DOCKET-50277-83) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. Final Environmental Statement. (Directorate of Licensing (AEC), Washington, D. C.). Apr 1973. 419p. (DOCKET-50278-77). Dep. NTIS $23.00.

The environmental effects of construction and operation of the Peach Bottom Power Reactor Units 2 and 3 are examined. The descriptions include: the environment in the area, including the history, geography, geology, hydrology, climatology, ecology, land and water use including chemical characteristics; the facility and its effluents; the impacts from construction and operation of the facility; alternatives to the proposed action; irreversible and irretrievable long-term commitments of resources from plant operation; need for power; and the benefits-cost analysis of the proposed plant operation. (DCC)

29656 (DOCKET-50278-78) PEACH BOTTOM ATOMIC POWER STATION, UNIT 3. Inspection Report No. 50-278/72-04. (Philadelphia Electric Co., PA). 11 Dec 1972. 12p. Dep. NTIS $3.00.

29657 (DOCKET-50280-117) SURRY POWER STATION, UNITS 1 AND 2. Reevaluation of Excore Detectors. (Virginia Electric and Power Co., Richmond). 25 Aug 1973. 1p. (DOCKET-50281-94). Dep. NTIS $3.00.

29658 (DOCKET-50280-121) SURRY POWER STATION, UNITS 1 AND 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 11p. (DOCKET-50281-97). Dep. NTIS $3.00.

29659 (DOCKET-50281-95) SURRY POWER STATION, UNIT 2. Inspection Report No. 50-281/72-10. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 27 Oct 1972. 3p. Dep. NTIS $3.00.

29660 (DOCKET-50282-100) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2. Final Safety Analysis Report, Amendment 32. (Northern States Power Co., Minneapolis, Minn.). 30 Mar 1973. 285p. (DOCKET-50306-95). Dep. NTIS $16.25.

Additional information on the containment system, testing program, and technical specifications for the Prairie Island Nuclear Generating Plant, Units 1 and 2 is presented. (JWR)

29661 (DOCKET-50285-86) FORT CALHOUN STATION, UNIT 1. Inspection of May 18-19, 1972. (Directorate of Regulatory Operations (AEC), Denver Colo. Region IV). 1 Jun 1972. 3p. Dep. NTIS $3.00.

29662 (DOCKET-50285-88) FORT CALHOUN STATION, UNIT 1. Inspection Report No. 50-285/75-03. (Directorate of Regulatory Operations (AEC), Denver, Colo. Region IV). 12 Mar 1973. 19p. Dep. NTIS $3.00.

29663 (DOCKET-50286-72) INDIAN POINT NUCLEAR GENERATING UNIT 3. Inspection Report No. 73-02. (Directorate of Regulatory Operations (AEC), Newark, NJ Region I). 12 Mar 1973. 6p. Dep. NTIS $3.00.

29664 (DOCKET-50286-73) INDIAN POINT NUCLEAR GENERATING UNIT 3. Applicant's Environmental Report, Supplement 6. (Consolidated Edison Co. of New York, Inc., New York). 5 Apr 1973. 92p. Dep. NTIS $6.75.

29665 (DOCKET-50286-74) INDIAN POINT NUCLEAR GENERATING UNIT 3. Modifications to Electrical and Mechanical Design. (Consolidated Edison Co. of New York, Inc., New York). 9 Apr 1973. 3p. Dep. NTIS $3.00.

29666 (DOCKET-50286-75) INDIAN POINT NUCLEAR GENERATING UNIT 3. Final Facility Description and Safety Analysis Report, Supplement 16. (Consolidated Edison Co. of New York, Inc., New York). Apr 1973. 73p. Dep. NTIS $5.75.

Additional information on the site, control system, radioactive waste disposal, and testing procedures for the Indian Point Nuclear Generating Unit 3 is presented. (JWR)

29667 (DOCKET-50289-93) THREE MILE ISLAND NUCLEAR STATION, UNIT 1. Inspection Report No. 50-289/73-01. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 7 Feb 1973. 19p. Dep. NTIS $3.00.

29668 (DOCKET-50295-92) ZION STATION NUCLEAR POWER PLANT, UNITS 1 AND 2. Inquiry Reports Nos. 050-295/72-03Q; 050-304/72-06Q; 050-295/72-04Q; 050-304/72-07Q. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 29 Sep 1972. 3p. (DOCKET-50304-85). Dep. NTIS $3.00.

Information is presented concerning modifications to heat exchangers and installation of main steam line safety relief valves. (DCC)

29669 (DOCKET-50295-94) ZION STATION NUCLEAR POWER PLANT, UNIT 1. Inspection Reports Nos. 73-09 and

73-11. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 16 Mar 1973. 22p. Dep. NTIS $3.25.

29670 (DOCKET-50295-95) ZION STATION NUCLEAR POWER PLANT, UNITS 1 AND 2. Inspection Reports Nos. 73-06 and 73-02. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 14 Mar 1973. 16p. (Docket-50304-86). Dep. NTIS $3.00.

29671 (DOCKET-50295-96) ZION STATION NUCLEAR POWER PLANT, UNIT 1. Facility Operating License DPR-39. Notice of Issuance of Facility Operating License. (Directorate of Licensing (AEC), Washington, D. C.). Apr 1973. 14p. Dep. NTIS $3.00.

29672 (DOCKET-50295-97) ZION STATION NUCLEAR POWER PLANT, UNITS 1 AND 2. Appendix A, Radiological Safety Technical Specifications. Appendix B, Environmental Technical Specifications. (Commonwealth Edison Co., Chicago, Ill.). 6 Apr 1973. 371p. (DOCKET-50304-87). Dep. NTIS $20.75.

29673 (DOCKET-50298-72) COOPER NUCLEAR STATION. Valve Wall Thickness. (Directorate of Regulatory Operations (AEC), Denver, Colo. Region IV). 5 Feb 1973. 2p. Dep. NTIS $3.00.

29674 (DOCKET-50298-73) COOPER NUCLEAR STATION. Final Safety Analysis Report, Amendment 20. (Nebraska Public Power District, Columbus). 6 Apr 1973. 92p. Dep. NTIS $6.75.

Requested additional data on the effect of pipe breaks on safety systems outside the primary containment at the Cooper Nuclear Station are presented. (JWR)

29675 (DOCKET-50302-65) CRYSTAL RIVER NUCLEAR GENERATING PLANT, UNIT 3. Inspection Report No. 50-302/72-4. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 26 Oct 1972. 4p. Dep. NTIS $3.00.

29676 (DOCKET-50302-66) CRYSTAL RIVER NUCLEAR GENERATING PLANT, UNIT 3. Voids in Concrete Under Personnel Hatch. (Directorate of Regulatory Operations (AEC), Washington, D. C.). 6 Feb 1973. 2p. Dep. NTIS $3.00.

29677 (DOCKET-50302-67) CRYSTAL RIVER NUCLEAR GENERATING PLANT, UNIT 3. Hurricane Protection. (Florida Power Corp., St. Petersburg). 28 Mar 1973. 7p. Dep. NTIS $3.00.

29678 (DOCKET-50302-68) CRYSTAL RIVER NUCLEAR GENERATING PLANT, UNIT 3. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 4p. Dep. NTIS $3.00.

29679 (DOCKET-50312-66) RANCHO SECO NUCLEAR GENERATING STATION, UNIT 1. Valve Operator Switches. (Sacramento Municipal Utility District, Calif.). 22 Dec 1973. 2p. Dep. NTIS $3.00.

29680 (DOCKET-50312-68) RANCHO SECO NUCLEAR GENERATING STATION, UNIT 1. Interim Report on Fuel Densification. (Sacramento Municipal Utility District, Calif.). 2 Apr 1973. 4p. Dep. NTIS $3.00.

29681 (DOCKET-50312-69) RANCHO SECO NUCLEAR GENERATING STATION, UNIT 1. Inspection Report 050-0312/73-01. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 13 Mar 1973. 10p. Dep. NTIS $3.00.

29682 (DOCKET-50313-70) ARKANSAS NUCLEAR ONE, UNITS 1 AND 2. Inspection of October 25-27, 1972. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 19 Dec 1972. 4p. (DOCKET-50368-39). Dep. NTIS $3.00.

29683 (DOCKET-50313-71) ARKANSAS NUCLEAR ONE, UNIT 1. Final Safety Analysis Report, Amendment 36. (Arkansas Power and Light Co., Little Rock). 6 Apr 1973. 118p. Dep. NTIS $8.00.

Additional information on the quality assurance program, engineered safeguards, operations aspects, personnel, and testing program for the Arkansas Nuclear One Power Reactor, Unit 1 is presented. (JWR)

29684 (DOCKET-50313-72) ARKANSAS NUCLEAR ONE, UNIT 1. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 10p. Dep. NTIS $3.00.

29685 (DOCKET-50315-102) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Preoperational Environmental Monitoring Report, August-December 1971. (Eberline Instrument Corp., Santa Fe, N. Mex. Dept. of Nuclear Sciences). 1971. 56p. (DOCKET-50316-102). Dep. NTIS $5.00.

For Indiana and Michigan Power Co., New York.

29686 (DOCKET-50315-103) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Preoperational Environmental Monitoring Report, January 1-June 30, 1972. (Eberline Instrument Corp., Sante Fe, N. Mex. Dept. of Nuclear Sciences). 1972. 58p. (DOCKET-50316-103). Dep. NTIS $5.00.

For Indiana and Michigan Power Co., New York.

29687 (DOCKET-50315-104) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Benton Harbor Power Plant Limnological Studies. Part X. Cook Plant Preoperational Studies, 1971. (Michigan Univ., Ann Arbor. Great Lakes Research Div.). Aug 1972. 152p. (Docket-50316-104). Dep. NTIS $9.75.

29688 (DOCKET-50315-105) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Benton Harbor Power Plant Limnological Studies. Part XI. Winter Operations, 1971-1972. (Michigan Univ., Ann Arbor. Great Lakes Research Division). Sep 1972. 23p. (Docket-50316-105). Dep. NTIS $3.25

29689 (DOCKET-50315-106) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Benton Harbor Power Plant Limnological Studies. Part XII. Studies of the Fish Population near the Donald C. Cook Nuclear Power Plant, 1972. (Michigan Univ., Ann Arbor. Great Lakes Research Div.). Mar 1973. 119p. (DOCKET-50316-106). Dep. NTIS $8.00.

For American Electric Power Service Corp., New York and Indiana and Michigan Electric Co., New York.

29690 (DOCKET-50315-107) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Request for Extension of Time for Removal of Temporary Harbor. (Indiana and Michigan Electric Co., Fort Wayne, Ind.). 13 Mar 1973. 31p. (DOCKET-50316-107). Dep. NTIS $3.75.

29691 (DOCKET-50315-108) DONALD C. COOK NUCLEAR PLANT, UNIT 1. Inspection Report No. 050-315/73-02. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 19 Mar 1973. 8p. Dep. NTIS $3.00.

29692 (DOCKET-50315-109) DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2. Committed to Treatment of Blowdown Vapor. (Indiana and Michigan Power Co., New York). 3 Apr 1973. 3p. (DOCKET-50316-108). Dep. NTIS $3.00.

29693 (DOCKET-50317-84) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Order Extending Completion Dates November 1, 1974 and November 1, 1975. (Directorate of Licensing (AEC), Washington, DC). 27 Mar 1973. 5p. (DOCKET-50318-81). Dep. NTIS $3.00.

29694 (DOCKET-50317-86) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Final Safety Analysis Report, Amendment 34. (Baltimore Gas and Electric Co., MD). 23 Mar 1973. 206p. (DOCKET-50318-83). Dep. NTIS $12.50.

Information is presented concerning the rupture of piping systems outside the containment system. (DCC)

29695 (DOCKET-50317-87) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Final Environmental Statement. (Directorate of Licensing (AEC), Washington, DC). Apr 1973. 322p. (DOCKET-50318-84). Dep. NTIS $18.25.

The environmental effects of construction and operation of the Calvert Cliffs Power Reactor Units 1 and 2 are examined. The descriptions include: the environment in the area, including the history, geography, geology, hydrology, climatology, ecology, land and water use including chemical characteristics; the facility and its effluents; the impacts from construction and operation of the facility; alternatives to the proposed action; irreversible and irretrievable long-term commitments of resources from plant operation; need for power; and the benefits-cost analysis of the proposed plant operation. (DCC)

29696 (DOCKET-50317-88) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Inspection Reports Nos. 73-02 and 73-03. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 5 Mar 1973. 27p. (DOCKET-50318-85). Dep. NTIS $3.50.

29697 (DOCKET-50317-89) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Internal Corrosion Discovered in Diesel Engines. (Baltimore Gas and Electric Co., MD). 2 Apr 1973. 3p. (DOCKET-50318-86). Dep. NTIS $3.00.

29698 (DOCKET-50317-90) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Final Safety Analysis Report, Amendment 28. (Baltimore Gas and Electric Co., MD). 31 Oct 1972. 18p. (DOCKET-50318-87). Dep. NTIS $3.00.

Revised information is presented concerning the environmental monitoring technical specifications. (DCC)

29699 (DOCKET-50321-73) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. Inspection Report No. 50-321/72-11. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 22 Nov 1972. 7p. Dep. NTIS $3.00.

29700 (DOCKET-50321-74) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. Inspection Report No. 50-321/72-10. (Directorate of Regulatory Operations (AEC), Atlanta, GA. (USA). Region II). 20 Nov 1972. 21p. Dep. NTIS $3.25.

29701 (DOCKET-50321-75) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 10p. Dep. NTIS $3.00.

29702 (DOCKET-50324-72) BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2. Inspection Report Nos. 50-324/72-3, 50-325/72-5, 50-324/72-5, and 50-325/72-7. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 24 Oct 1972. 11p. (Docket-50325-73). Dep. NTIS $3.00.

29703 (DOCKET-50324-73) BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2. Construction Inspection Report Nos. 50-324/72-4 and 50-325/72-6. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Jan 1973. 24p. (DOCKET-50325-74). Dep. NTIS $3.25.

29704 (DOCKET-50324-74) BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2. Opinion of Department of Justice That There Is No Need for an Antitrust Hearing. (Department of Justice, Washington, D. C. Antitrust Div.). 11 Apr 1973. 6p. (DOCKET-50325-75). Dep. NTIS $3.00.

29705 (DOCKET-50324-75) BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2. Thin-Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 4p. (DOCKET-50325-76). Dep. NTIS $3.00.

29706 (DOCKET-50327-35) SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2. Inspection Reports 50-327/72-3 and 50-328/72-3. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 30 Jan 1973. 26p. (Docket-50328-33). Dep. NTIS $3.50.

29707 (DOCKET-50331-90) DUANE ARNOLD ENERGY CENTER. Safety Evaluation, Supplement 2. (Directorate of Licensing (AEC), Washington, D. C.). 9 Apr 1973. 14p. Dep. NTIS $3.00.

29708 (DOCKET-50333-85) JAMES A. FITZPATRICK NUCLEAR POWER PLANT. Inspection Report 50-333/72/08. (Power Authority of the State of New York). 31 Oct 1972. 8p. Dep. NTIS $3.00.

29709 (DOCKET-50333-86) JAMES A. FITZPATRICK NUCLEAR POWER PLANT. Inspection Report 50-333/72-09. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 10 Nov 1972. 22p. Dep. NTIS $3.25.

29710 (DOCKET-50333-87) JAMES A. FITZPATRICK NUCLEAR POWER PLANT. Inquiry Report No. 50-333/01Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 15 Jan 1973. 3p. Dep. NTIS $3.00.

Information is presented concerning cracks in the concrete support structure for the pressure vessel. (DCC)

29711 (DOCKET-50334-58) BEAVER VALLEY POWER STATION, UNIT 1. Inquiry Report No. 50-334/73-02Q. (Directorate of Regulatory Operations (AEC), Newark, N. J. Region I). 23 Feb 1973. 3p. Dep. NTIS $3.00

Information is presented concerning linear indications in pressure vessel nozzles. (DCC)

29712 (DOCKET-50335-53) ST. LUCIE PLANT, UNIT 1. Inspection Report No. 50-335/72-5. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 15 Jan 1973. 16p. Dep. NTIS $3.00.

29713 (DOCKET-50335-54) ST. LUCIE PLANT, UNIT 1. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 4p. Dep. NTIS $3.00.

29714 (DOCKET-50338-59) NORTH ANNA POWER STATION, UNITS 1, 2, 3, AND 4. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 16 Feb 1973. 10p. (DOCKET-50339-56; DOCKET-50404-45; DOCKET-50405-45). Dep. NTIS $3.00.

29715 (DOCKET-50338-60) NORTH ANNA POWER STATION, UNITS 1, 2, 3, AND 4. Final Environmental Statement. (Directorate of Licensing (AEC), Washington, DC). Apr 1973. 471p. (DOCKET-50339-57; DOCKET-50404-46; DOCKET-50405-46). Dep. NTIS $25.75.

The environmental effects of construction and operation of the North Anna Power Station, Units 1, 2, 3, and 4 are examined. The descriptions include: (1) the environment in the area, including the history, geography and geology, hydrology, climatology, ecology, land and water use including chemical characteristics, (2) the facility and its effluents, (3) the impacts from construction and operation of the unit, (4) alternatives to the proposed action, (5) irreversible and irretrievable long-term commitments of resources from plant operation, (6) need for power, and (7) the benefits-cost analysis of the proposed plant operation. (JWR)

29716 (DOCKET-50341-52) ENRICO FERMI ATOMIC POWER PLANT, UNIT 2. Inspection Report 050-341/73-03. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 21 Mar 1973. 14p. Dep. NTIS $3.00.

29717 (DOCKET-50344-52) TROJAN NUCLEAR PLANT. Inspection Report 73-02. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 6 Apr 1973. 8p. Dep. NTIS $3.00.

29718 (DOCKET-50344-53) TROJAN NUCLEAR PLANT. Vendor Inspection Report 99900048/7301. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 11 Apr 1973. 11p. Dep. NTIS $3.00.

29719 (DOCKET-50344-54) TROJAN NUCLEAR PLANT. Inspection Report 050-0344/73-03. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 13 Apr 1973. 6p. Dep. NTIS $3.00.

29720 (DOCKET-50346-53) DAVIS-BESSE NUCLEAR POWER STATION. Steps Taken to Correct Items of Noncompliance Brought to Attention Following Inspections, November 29-30, 1972 and December 12-13, 1972. (Toledo Edison Co., Ohio). 2 Mar 1973. 23p. Dep. NTIS $3.25.

Requested information on the quality assurance program for construction of the Davis-Besse Nuclear Power Station is presented. (JWR)

29721 (DOCKET-50346-54) DAVIS-BESSE NUCLEAR POWER STATION. Steam Generator Welds. Shop Welds of Pipe Spools. (Toledo Edison Co., Ohio). 18 Jan 1973. 4p. Dep. NTIS $3.00.

29722 (DOCKET-50346-55) DAVIS-BESSE NUCLEAR POWER STATION. Fuel Densification Effects. (Toledo Edison Co., Ohio). 20 Feb 1973. 2p. Dep. NTIS $3.00.

29723 (DOCKET-50346-56) DAVIS-BESSE NUCLEAR POWER STATION. Inspection Report 050-346/73-01. (Directorate of Regulatory Operations (AEC), Glen Ellyn, Ill. Region III). 23 Mar 1973. 12p. Dep. NTIS $3.00.

29724 (DOCKET-50348-55) JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 11p. (DOCKET-50364-47). Dep. NTIS $3.00.

29725 (DOCKET-50363-50) FORKED RIVER NUCLEAR GENERATING STATION, UNIT 1. Application of Reactor Construction Permit and Operating License, Amendment 24. (Jersey Central Power and Light Co., Morristown, N. J.). 6 Apr 1973. 68p. Dep. NTIS $5.50.

Financial data on the owners of the Forked River Power Reactor Unit 1 are presented. The 1972 Annual Reports for the General Public Utilities Corporation, Jersey Central Power and Light Company, and New Jersey Power and Light Company are included. (DCC)

29726 (DOCKET-50366-37) EDWIN I. HATCH NUCLEAR PLANT, UNIT 2. Inspection Report No. 50-366/72-3. (Directorate of Regulatory Operations (AEC), Atlanta, GA. (USA). Region II). 12 Nov 1972. 4p. Dep. NTIS $3.00.

29727 (DOCKET-50366-38) EDWIN I. HATCH NUCLEAR PLANT, UNIT 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 9p. Dep. NTIS $3.00.

29728 (DOCKET-50368-40) ARKANSAS NUCLEAR ONE, UNIT 2. Loss-of-Coolant Accident, Supplementary Information. (Arkansas Power and Light Co., Little Rock). 27 Oct 1972. 2p. Dep. NTIS $3.00.

29729 (DOCKET-50368-41) ARKANSAS NUCLEAR ONE, UNIT 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 10p. Dep. NTIS $3.00.

29730 (DOCKET-50369-37) McGUIRE NUCLEAR STATION, UNITS 1 AND 2. Emergency Plan. (Directorate of Regulatory Operations (AEC), Atlanta, GA (USA). Region II). 4 Apr 1973. 3p. (Docket-50370-37). Dep. NTIS $3.00.

29731 (DOCKET-50369-38) McGUIRE NUCLEAR STATION, UNITS 1 AND 2. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 16 Feb 1973. 4p. (DOCKET-50370-38). Dep. NTIS $3.00.

29732 (DOCKET-50376-37) AGUIRRE NUCLEAR PLANT, UNIT 1. Thin Wall Valves. (Puerto Rico Water Resources Authority, San Juan). 10 Apr 1973. 9p. Dep. NTIS $3.00.

29733 (DOCKET-50376-38) AGUIRRE NUCLEAR PLANT, UNIT 1. Inspection Report Contains No Proprietary Information. (Puerto Rico Water Resources Authority, San Juan). 10 Apr 1973. 2p. Dep. NTIS $3.00.

29734 (DOCKET-50382-55) WATERFORD STEAM ELECTRIC STATION, UNITS 3 AND 4. License Conditions of Department of Justice. (Department of Justice, Washington, D. C. Antitrust Div.). 30 Mar 1973. 11p. (DOCKET-50383-14). Dep. NTIS $3.00.

29735 (DOCKET-50382-56) WATERFORD STEAM ELECTRIC STATION, UNIT 3. Loss-of-Coolant, Clarification of Response. (Louisiana Power and Light Co., New Orleans). 19 Dec 1972. 1p. Dep. NTIS $3.00.

29736 (DOCKET-50382-57) WATERFORD STEAM ELECTRIC STATION, UNIT 3. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 4p. Dep. NTIS $3.00.

29737 (DOCKET-50382-58) WATERFORD STEAM ELECTRIC STATION, UNIT 3. Preliminary Safety Analysis Report, Amendment 33. (Louisiana Power and Light Co., New Orleans). 9 Apr 1973. 18p. Dep. NTIS $3.00.

Additional information on the Essential Cooling Water System at the Waterford Steam Electric Station, Unit 3 is presented. (JWR)

29738 (DOCKET-50395-42) VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1. Fuel Densification Effects. (South Carolina Electric and Gas Co., Columbia). 22 Dec 1972. 2p. Dep. NTIS $3.00.

29739 (DOCKET-50395-43) VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1. Thin Wall Valves. (Directorate of Regulatory Operations (AEC). Atlanta, GA (USA). Region II). 10 Apr 1973. 9p. Dep. NTIS $3.00.

29740 (DOCKET-50397-39) HANFORD NO. 2 NUCLEAR POWER PLANT. Inspections June 6-8, 1972 and June 12-14, 1972. (Directorate of Regulatory Operations (AEC), Berkeley, Calif. (USA). Region V). 4 Aug 1972. 4p. Dep. NTIS $3.00.

Information is presented concerning the quality assurance program. (DCC)

29741 (DOCKET-50400-39) SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 1, 2, 3 AND 4. Fuel Densification Effects. (Carolina Power and Light Co., Raleigh, N. C.). 9 Jan 1973. 1p. (DOCKET-50401-39; DOCKET-50402-39; DOCKET-50403-39). Dep. NTIS $3.00.

29742 (DOCKET-50400-40) SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 1, 2, 3, AND 4. Preliminary Safety Analysis Report, Amendment 25. (Carolina Power and Light Co., Raleigh, NC). 6 Apr 1973. 89p. (DOCKET-50401-40; DOCKET-50402-40; DOCKET-50403-40). Dep. NTIS $6.50.

Requested additional information on the site, containment system, buildings and equipment, and the power conversion system for the Shearon Harris Nuclear Power Plant, Units 1, 2, 3, and 4 is presented. (JWR)

29743 (DOCKET-50400-41) SHEARON HARRIS NUCLEAR POWER PLANT, UNITS 1, 2, 3, AND 4. Thin Wall Valves. (Directorate of Regulatory Operations (AEC), Atlanta, Ga. (USA). Region II). 10 Apr 1973. 4p. (Docket 50401-41; DOCKET-50402-41; DOCKET-50403-41). Dep. NTIS $3.00.

29744 (DOCKET-50404-47) NORTH ANNA POWER STATION, UNITS 3 AND 4. Positions of Virginia Electric and Power Company with Respect to Specific Caveats of the ACRS. (Virginia Electric and Power Co., Richmond). 4 Apr 1973. 6p. (DOCKET-50405-47). Dep. NTIS $3.00.

Additional safety related information on the North Anna Power Station, Units 3 and 4 is presented. (JWR)

29745 (DOCKET-50409-42) LA CROSSE BOILING WATER REACTOR. Provisional Operating Authorization No. DPRA-6, Amendment 4, Quality Assurance Program. (Dairyland Power Cooperative, La Crosse, Wis.). 21 Mar 1973. 34p. Dep. NTIS $3.75.

29746 (DOCKET-50409-43) LA CROSSE BOILING WATER REACTOR. Fuel Densification Effects. (Dairyland Power Cooperative, La Crosse, Wis.). 26 Dec 1972. 1p. Dep. NTIS $3.00.

29747 (DOCKET-50409-44) LA CROSSE BOILING WATER REACTOR. Valve Wall Thickness. (Dairyland Power Cooperative, La Crosse, Wis.). 16 Jan 1973. 5p. Dep. NTIS $3.00.

29748 (DOCKET-50413-13) CATAWBA NUCLEAR STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 5. (Duke Power Co., Charlotte, N. C.). 30 Mar 1973. 243p. (Docket-50414-13). Dep. NTIS $14.25.

Revised and requested data are presented concerning structures, engineered safeguards, site, quality assurance program, and radioactive effluents. (DCC)

29749 (DOCKET-50410-24) NINE MILE POINT NUCLEAR STATION, UNIT 2. Preliminary Safety Analysis Report, Amendment 8. (Niagara Mohawk Power Corp., Syracuse, N. Y.). 30 Mar 1973. 57p. Dep. NTIS $5.00.

Requested additional data on postulated high-energy pipe failures outside the containment for the Nine Mile Point Power Reactor, Unit 2 are presented. (JWR)

29750 (DOCKET-50416-20) GRAND GULF NUCLEAR STATION, UNITS 1 AND 2. Preliminary Safety Analysis Report, Amendment 5. (Mississippi Power and Light Co., Jackson (USA)). 9 Apr 1973. 34p. (DOCKET-50417-20). Dep. NTIS $3.75.

Additional information on the containment spray systems for the Grand Gulf Nuclear Station, Units 1 and 2 is presented. (JWR)

29751 (DOCKET-50423-13) MILLSTONE NUCLEAR POWER STATION, UNIT 3. Loads and Resources for the Peabody (Mass.) Municipal Light Plant. (Millstone Point Co., Hartford, Conn.). 4 Apr 1973. 3p. Dep. NTIS $3.00.

29752 AMERICAN NATIONAL STANDARD FOR REACTOR PLANTS AND THEIR MAINTENANCE. Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants. ANSI N45.2.9-1972. New York; American Society of Mechanical Engineers (1972). 35p.

29753 DRAWBACKS OF NUCLEAR POWER. Engstroem, S. Tek. Tidskr.; 102: No. 10, 32-34(May 1972). (In Swedish).

It seems to be possible to site nuclear power plants of a moderate size near urban areas. Difficulties are expected when siting rather large units or fast reactors near urban areas. Krypton is expected to create radiation hazards near the year 2000. The fission product will be solidified. One of the disposal concepts is to store the waste in salt. Plutonium will create problems. (SW)

Steam and Power Conversion Systems

Refer also to abstract 29809.

Propulsion and Auxiliary Power Reactors

Refer also to abstracts 27496 and 27497.

29754 CAVITY REACTOR WITH TWO STAGE SEPARATION. Von Ohain, H. J. P.; Keller, M. R. (to Secretary of the United States Air Force). U. S. Patent 3,713,970. 30 Jan 1973. Filed date 13 Jan 1970. 4p.

A colloidal gas core nuclear reactor having a high tensile strength outer semispheroidal pressure shell enclosing a moderator body member which surrounds a central cavity with an expansion nozzle at one end is described. The greatest cavity radius is at the end remote from the nozzle. Hydrogen gas is supplied to the cavity to provide a vortex flow within the cavity. A conical duct is provided between the throat of the nozzle and the expansion portion of the nozzle. A groove and particle catcher is provided between the duct and expansion portion of the nozzle. The groove leads to a particle outlet duct. (2 claims, 1 drawing figure) (Official Gazette)

29755 NUCLEAR FUEL MANUFACTURE AND CRITICALITY TEST ON SHORE FOR THE NUCLEAR SHIP MUTSU. Shimooke, T.; Otsuka, T. (Japan Nuclear Ship Development Agency, Tokyo). Genshiryokusen; No. 104, 2565-2591(Jun 1972). (In Japanese).

The basic philosophy on the design of nuclear fuel for the nuclear ship "Mutsu" is safe construction to temperature, pressure, and radiation in the operational condition of a reactor, safe construction to the rolling and vibration of hull, and sufficient strength for fuel replacement and transportation. The fuel is UO_2 pellets of low enrichment, and 2.77 tons of them are charged. Fuel cladding is SUS 27 tubes of 10.5 mm outside diameter. 112 fuel rods and 9 burnable poison rods are arranged in an 11×11 array. Fuel assemblies, fuel transport containers, and fuel storage racks were delivered in July 1971, and the criticality test on shore was finished at the end of 1971. They were carried in the fuel storehouse without accident on Jan. 29, 1972. Inspection was carried out during manufacture by GJ and NK, and intra-company inspection and shop attendance inspection were also executed. An autonomous confirmation test was carried out on main constituent material by sampling. 9 fuel storage racks, each containing 4 fuel assemblies, were made, and their safety against earthquake and criticality was guaranteed. 4 fuel transport containers, each containing 2 fuel assemblies, were manufactured, and soundness and anti-vibration performance were confirmed by drop tests and road transportation tests. The criticality test on shore was carried out with a Mitsubishi criticality experiment facility in order to establish a fuel loading program, to substitute for the test difficult to carry out on board, to improve efficiency of the test on board, and to confirm design values regarding performance and safety. Testing methods and results of initial criticality; fuel charging; measurement of shut down margin and stuck rod margin; uniformity of the fuel and control rods; measurement of temperature coefficient of moderator, reactivity effect of liquid poison, power output distribution, and equivalent reactivity of the control rods; response characteristics of detectors; and measurement of excess reactivity are reported. (JA)

Research and Test Reactors

Refer also to abstracts 27675 and 29003.

29756 (FEI-317) EXPERIMENTAL INVESTIGATION OF SOME SPACE-ENERGY CHARACTERISTICS OF PF-4F-9M URAN BERYLLIUM ASSEMBLY. Kuznetsov, V. A.; Mogil'ner, A. I.; Zolotarev, K. I.; Kurakov, N. P.; Satmari, Z.; Serov, V. A.; Turi, L.; Fisher, A.; Chernov, L. A. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Obninsk. Fiziko-Tekhnicheskii Institut; Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete, Budapest). 1971. 50p. (In Russian). INIS.

Data are given on fission densities in a reactor core, cadmium ratios, and cross section ratios of some fissioning isotopes relative to ^{10}B. Considerable consideration was given to the determination of neutron spectra over a broad range of energies (0.33 eV to 18 MeV) with the assistance of the RFSP code and a Ge(Li) measurement of activation integrals. The measurements were conducted on a heterogeneous U–Be assembly possessing an intermediate neutron spectrum and mounted on a PF-4 test stand. (tr-auth)

29757 IMPROVED VERSION OF THE METHANE COLD NEUTRON SOURCE. Dimic, V. (Univ. of Ljubljana, Yugoslavia). Nucl. Instrum. Methods; 107: No. 2, 405-406(1973).

A new version of a cold neutron source facility, using methane as a moderator, has been installed in one of the tangential beam tubes of the reactor TRIGA Mark II at the Institute "Jožef Stefan," Ljubljana. The construction and performance of the facility are described. (auth)

29758 MEASUREMENT OF MECHANICAL INTEGRITY IN A REACTOR FUEL ELEMENT BY THE ANALYSIS OF EXTERNAL VIBRATION SIGNALS. Harris, R. W. (Australian Atomic Energy Commission, Sutherland). Nucl. Eng. Des.; 23: No. 2, 182-186 (1972).

The mechanical integrity of a HIFAR (=HIgh Flux Australian Reactor) fuel element assembly, specifically the clearances associated with an internal, concentric specimen-irradiation tube ("liner") and the mechanical rigidity of the annular fuel element plates, can be monitored by analyzing signals obtained from vibration sensors mounted in an easily accessible location on the fuel element shield plug. The approach employed could be adapted for use as a diagnostic tool on other types of fuel element assemblies. (auth)

29759 IRRADIATION DEVICE FOR A FAST NEUTRON NUCLEAR REACTOR. Besoux, M.; Mesnage, B.; Richier, A. (to Commissariat a l'Energie Atomique). French Patent 2,126,079. 6 Oct 1972. Filed date 23 Feb 1971. 10p. (In French).

An irradiation device for a fast liquid Na cooled reactor is described. The device is withdrawable, capable of being manipulated, and accessible from the exterior of the biological shield of the reactor. The device crosses a rotating plug; the bottom of the device in the lowest position is contained in the free space surrounding the core; the upper part of the device is positioned between the core and the rotating plug. In this position it facilitates the rotation of the plug. The different parts of the device are described: released system, sheath, fluid tight joints, guiding system, and system for controlling the gaseous environment of the device. (FR)

29760 dc CHANNELS FOR CONTROL OF FAST CRITICALITY FACILITY. Pethe, V. A.; Kumar, R.; Patankar, A. A.; Rathod, N. C.; Godgaonkar, M. D.; Gogate, S. A. (Bhabha Atomic Research Centre, Trombay, India). pp 579-583 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol.14B).

29761 NEUTRONIC MEASUREMENTS PROPOSED IN FAST BREEDER TEST REACTOR. Shankar Singh, R. (Reactor Research Centre, Kalpakkam, India). pp 595-601 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1–4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221–(Vol. 14B).

Reactor Components, Fuels, and Accessories

Refer also to abstracts 28109, 28111, 28159, 28168, 28180, 28183, 28184, 28209, 28214, 28321, 28322, 28325–28327, and 28336.

29762 (AAEC/LIB/Bib-363) FLOW INDUCED VIBRATIONS OF REACTOR CORE COMPONENTS. A Bibliography. Newland, E. A. (Comp.). (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Aug 1972. 53p. Dep. NTIS (U. S. Sales Only) $4.75.

Fourteen references deal with selected references on vibration and 220 references with flow-induced vibrations in core components. Arrangement is chronological by year and alphabetical by author within each year. The period covered is 1948–1972 and reference is made to abstracts for citations in INIS, NSA, and EI. (AT)

29763 (ORNL-tr-2646) REACTOR PRESSURE VESSEL OF PRETRESSED CONCRETE. Study for a Draft Standard. Jun 1972. Translated for Oak Ridge National Lab., TN from a German paper. 28p. Dep. NTIS.

29764 (PTHM-FRM-106) SAFETY CHECKUP OF THE NEW SHIM RODS AND DESCRIPTION OF THE NEW CONTROL ROD. Lades, H. (Technische Universitaet, Munich (West Germany)). Jul 1970. 8p. (In German). INIS.

The construction of new shim rods is illustrated. The safety tests include the results of measurements of falling time and falling speed, the calculation of heating in the radiation field of the reactor, and evaluations as to the pressure formation by development of gaseous helium. A description of the new control rod is presented. (INIS)

29765 (RDT-INDEX-3-73) INDEX OF RDT STANDARDS. (Division of Reactor Development and Technology (AEC), Washington, D. C.). Mar 1973. 35p. RSO.

29766 EXPERIENCE WITH THE FABRICATION OF AUSTENITIC STAINLESS STEEL STRUCTURES FOR WATER-COOLED NUCLEAR REACTORS. Frigerio, C.; Previti, G.; Bertolucci, G. C. Com. Naz. Energ. Nucl., Notiz.; 18: No. 11, 32-42(Nov 1972). (In Italian).

The experience in recent years by FIAT Co. in the fabrication of austenitic stainless steel structures for nuclear reactors is discussed. Particular attention is given to the latest products supplied, such as the core-support structures of both marine type (N/S Otto Hahn) and for big power plants, control rods and fuel-element structural components. (auth)

29767 CONSTRUCTION OF THE STRUCTURAL ASSEMBLY OF A REACTOR. Brandstetter, R. (to Commissariat a l'Energie Atomique). French Patent 2,124,140. 22 Sep 1972. Filed date 9 Feb 1971. 14p. (In French).

A procedure for assembling a fast metal-cooled nuclear reactor at a minimum cost is described. This type of reactor possesses three vessels positioned inside one another: the inner vessel which houses the reactor core, the intermediate vessel,

which contains molten metal, and the outer vessel, which can replace the intermediate vessel in the event of failure. In this procedure, the vessels are successively introduced into the pile-block well; first the safety vessel, which is retained by the walls of the well, then the principal vessel which is positioned inside the safety vessel. The two vessels are joined together in-situ. Finally the primary vessel is introduced. In order to avoid any rigid fixing of this vessel, it is suspended inside the principal vessel. The whole assembly is then suspended from the slab. The adjustment of the suspension allows a given distribution of forces to be applied to the walls of the well and to the slab. (FR)

29768 NUCLEAR FUEL. Bairiot, H. (to Belgonucleaire SA). Belgian Patent 740,674. 23 Oct 1969.

A moderator block is described for a nuclear reactor cooled by gas at high temperature. It consists of channels capable of containing several fuel rods in the same transverse section of each channel. (BE)

29769 NUCLEAR REACTOR FUEL ELEMENT. Katell, A. (to RL Industries, Inc.). U. S. Patent 3,713,975. 30 Jan 1973. Filed date 2 Dec 1969. 4p.

A nuclear reactor fuel element includes a tube having end plugs sealing the ends. A body of nuclear fuel is disposed in part of the tube and defines a plenum chamber adjacent to one of the end plugs. A plenum compression spring has one end in engagement with a flat disc-like member which engages the body of nuclear fuel. The opposite end of the plenum spring is in engagement with a flat surface formed on a spring seat means including a substantially conical portion which has single point contact with the central part of the inner surface of the adjacent end plug. (auth)

29770 NUCLEAR FUEL ASSEMBLY. Normand, G.; Venobre, H. (to Commissariat a l'Energie Atomique). U. S. Patent 3,713,973. 30 Jan 1973. Priority date 31 Jan 1968, France. 4p.

A nuclear fuel assembly comprises a central portion having a polygonal cross section and two end portions. One of the end portions has a smaller cross-section than the central portion and is provided with longitudinal lugs each forming a cam and terminating in a bevelled tip, said lugs being disposed in the line of extension of the ridges of said polygonal cross section. Each face of the other end portion is provided with a V-shaped ramp for supporting said bevelled tips and guiding said lugs toward the summits of said polygonal cross-section. (auth)

29771 METHOD FOR ANALYZING THE SPATIAL FUEL DISTRIBUTION OF A SAMPLE. Boehnel, K.; Wolff, J.; Kuechle, M. (to Gesellschaft fuer Kernforschung mbH). German Patent 2,032,836. 13 Jan 1972. 13p. (In German).

The method described is as follows: The intensity of the spectral lines of the gamma radiation (primary radiation) emitted in the radioactive decay of the substances contained in the sample as well as that of the lines of the characteristic x-radiation (secondary radiation) due to the photo effect of the gamma radiation is measured with the relationship of various intensities to each other then being compared with a standard ratio, thus indicating the distribution of the fuel in the specimen. In addition to this, the method will also yield information on the fuel content of the sample in terms of isotopes. (GF)

29772 NUCLEAR REACTOR FUEL ELEMENTS. Previti, G.; Roncarolo, P. U. S. Patent 3,713,974. 30 Jan 1973. Priority date 20 Dec 1968, Italy. 6p.

A nuclear reactor fuel element has a number of fuel rods arranged in a metallic sheath, the rods being spaced by a number of axially spaced grids. Some grids are fixed relative to the sheath while others can slide axially therein, and each fuel rod is frictionally connected to all the slidable grids but to only some of the fixed grids, said fuel rod passing freely through the other fixed grids. The fixed and slidable grids alternate in the central part of the fuel element, and in consequence the loading of the sheath as a result of differential thermal expansion is minimized. (auth)

29773 DEVICE FOR REMOTE POSITIONING OF THERMOCOUPLES IN A NUCLEAR REACTOR. Lions, N. (to Commissariat a l'Energie Atomique). U. S. Patent 3,716,450. 13 Feb 1973. Filed date 15 Sep 1969. 4p.

Remote positioning of thermocouples in proximity to the fuel assemblies of a nuclear reactor core is carried out by means of a device comprising an elongated cylindrical guide tube secured at one open extremity to the seal plug of the reactor vessel while the other extremity is closed by an end-piece which is mounted in proximity to the fuel assemblies and which has a smaller internal cross-sectional area than the guide tube. The device essentially comprises a flexible metallic positioning arm which is capable of sliding within the interior of the guide tube and at least one thermocouple cable mounted inside the positioning arm. That end of the cable which carries the sensitive element of the thermocouple is attached to the exterior of an elastic clamp which is secured to the positioning arm. The open end of the positioning arm is engaged within the guide tube until it penetrates in the end-piece, thereby closing the clamp and bringing the sensitive element into contact with the surface of the end-piece. (Official Gazette)

29774 CONTROL ROD DRIVE UNITS FOR NUCLEAR REACTORS. Mehren, F. (to Interatom Internationale Atomreaktorbau GmbH). U. S. Patent 3,715,269. 6 Feb 1973. Filed date 21 May 1969. 6p.

A control rod drive unit for use with nuclear reactors having a motor for effecting movement of a drive rod coupled to the control rod between positions corresponding to full insertion and full withdrawal of the control rod with respect to the reactor is described. There is also provided a seal for providing a gas tight sealing between the drive rod and the cover of the nuclear reactor with the motor connected to the drive rod, and a further seal for sealing the drive rod to the reactor operative upon the means for disconnecting the motor from the drive rod, and a further means for partially disengaging the first seal from the reactor cover. (Official Gazette)

29775 CALCULATION OF THE EXTRAPOLATION LENGTH IN A MULTILAYERED CONTROL ROD. Slizov, V. P.; Popov, B. I. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 8-12(1972). (In Russian).

The extrapolation length for an N-zone cylindrical control rod placed in the center of a core is obtained on the basis of the albedo method. Neutron moderation in the rod is taken into account. The algorithm proposed for the calculation of the extrapolation length is shown to be easily realized in multigroup reactor programs. (auth)

29776 GRAPHITE IN NUCLEAR REACTORS. Lore, J. (Societe Francaise d'Electrometallurgie, Paris). Chim. Ind., Genie Chim.; 105: No. 23, 1675-1680(Nov 1972). (In French).

Artificial graphite is a very useful material for atomic engineering, where it is used as a moderator for gas cooled thermal neutron reactors. This utilization necessitates an extremely pure material, and, in addition the best possible isotropic and mechanical characteristics. Graphites suitable for use in conjunction with reactors operating at successively higher temperatures were developed: CO_2 cooled natural uranium reactors for the French system (Grand EDF type reactors) and MAGNOX reactors for the English system; advanced reactors of the English system AGR using enriched uranium; high temperature (HTR) reactors cooled with He. (FR)

29777 REGULAR SYSTEM OF CLOSELY-SPACED NEUTRON ABSORBERS. Chikhladze, I. L.; Shevelev, Ya. V. At. Energ. (USSR); 34: No. 3, 163-169(Mar 1973). (In Russian).

A generalized method of designing reactor absorber systems using averaged neutron fluxes obtained by the integration of general solutions over the lattice pitch is presented. Regular systems of closely-packed neutron absorbers are considered and it is shown that in certain cases corrections to zero approximation are small, even when rods are spaced closely. The error arising when effective boundary conditions on the absorber surface are assumed to be equal for different distributions of neutron flux is determined. (auth)

29778 FUEL BUNDLES FOR NUCLEAR REACTORS. Bigge, W. B.; Roupe, G. A.; Lass, J. L.; Venier, D. A. (to General Electric Co.). German Patent 1,589,801. 20 Apr 1972. 57p. (In German).

A fuel bundle is described consisting of several fuel rods which are fixed together by mounting plates. At a least point at the upper mounting plate where the individual fuel rods of the bundle are to be fixed a device has been provided to receive and fasten a special rod filled with a material of high neutron capture cross section, so as to allow the removal of this special rod without detaching the remaining fuel rods of that particular bundle. The main purpose of this special rod is to enable changes to be made in the controlling efficiency of the proper control rod. The claims relate to the position, the mounting system, the filling material and the mode of action of this special rod. (GF)

29779 NUCLEAR REACTOR FUEL RODS. Bratton, R. J.; Roberts, E.; Smerd, P. G. (to Westinghouse Electric Corp.). German Patent 2, 150,413. 4 May 1972. 9p. (In German).

A fuel rod is described which consists of a fuel-filled thin-walled jacket encasing a tube closed at the ends. The inner part is under high pressure. The fission gas collecting chamber con-

tains a closed chamber with a low inner pressure whose walls are made of material allowing fission gas diffusion. (GF)

29780 BIMETALLIC SPACER GRID ARRANGEMENT. Krawiec, D. M. (to Combustion Engineering, Inc.). U. S. Patent 3,715,275. 6 Feb 1973. Filed date 2 Mar 1970. 4p.

A bimetallic spacer grid arrangement for fuel element support in nuclear reactors is described. A matrix of spacer elements formed from a first material having characteristic low neutron capture cross section has nested within it a matrix of spring elements formed of a second material having better stress relaxation properties than said first material. The spring elements consist of an interconnected series of strips of the second material having integral tab-like projections protruding laterally therefrom at selected points so as to serve as fuel element biasing members. (3 claims, 6 drawing figures) (Official Gazette)

29781 TESTING OF NUCLEAR COMPONENTS. Straub, H. (Winterthur Engineering Works Div., Switzerland). Sulzer Tech. Rev.; No. Nuclex 72, 5-17(1972).

Definite requirements are placed on the manufacturers of nuclear components with regard to their organization and manufacturing system. Good manufacturing facilities are also to be accompanied by a suitable infrastructure, which includes planning, design, calculations, computer programming, quality control, production engineering, testing sections, laboratories and, above all, qualified personnel. Because of these requirements, a quality control organization was set up in the Sulzer Group in 1971. This organization is independent of the sections directly concerned with producing the items and guarantees, with its quality assurance program, the customer complete compliance with the stipulated requirements. A description of the most important basic principles used in the testing of nuclear components and in the manufacture of high quality products in general is given in this article. Data, organizational layouts, possibilities and limitations are shown, so that all concerned receive a better overall conception, which improves the co-operation between the individuals involved. (auth)

29782 FISSION-GAS BEHAVIOR OF NUCLEAR OXIDE FUEL UNDER IRRADIATION AT HIGH TEMPERATURE. Doi, Akira; Inoue, Kiyoshi; Taniguchi, Kaoru (Hitachi Ltd., Kawasaki, Japan). Hitachi Hyoron; 54: No. 6, 483-487(Jun 1972). (In Japanese).

A study on the behavior of fission gas from nuclear oxide fuel was performed to obtain basic data for the design of fuel and fuel cladding. The oxide fuel was irradiated by neutrons at the temperature of 2000°C. The carrier gas which carried the fission gas was argon. The temperature distribution in the fuel elements was observed to determine heating conditions. Gamma-ray spectra of the fission gas in the carrier gas were measured. The amount of the fission gas emitted was independent from crystal growth at the temperature of 2000°C. The growth of crystals of uranium dioxide was seen at the time of center heating, and observed bubbles transferred along the gradient of temperature. This transfer had an important relation with the emission of the fission gas. Diffusion and the bubble transfer made the same amount of contribution to the emission of fission gas in the experiment. (JA)

29783 FUEL ASSEMBLY. Yellowlees, J. M. (to Societe Belge pour l'Industrie Nucleaire). Belgian Patent 785,095. 19 Jun 1972. 5p. (In French).

A fuel assembly for nuclear reactors is characterized by the exterior form of the can, fitted to the fuel pin bundle and modified in a manner to reduce the extent of the vertical planes. (tr-auth)

29784 EXPERIMENTAL DETERMINATION OF THE CONTRIBUTION OF ^{235}U AND ^{239}Pu TO THE BURNUP OF A PLUTONIUM-GENERATING FUEL. Schachter, L.; Hacman, D.; Popa, P. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 17: No. 6, 729-737(1972).

The experimental method used for the separate determination of the number of fissions produced in ^{235}U, and ^{239}Pu accumulated by neutron capture respectively, by measuring the activity of the fission products ^{106}Ru, ^{137}Cs, and ^{95}Zr, resulting from the irradiation of the plutonium generating fuel elements in the reactor is presented. The experimental results corrected for the decay during irradiation and cooling intervals as well as for self-shielding were compared with the values obtained by calculation. (auth)

Reactor Physics and Core Engineering

Physics

Refer also to abstract 29027.

29785 (IAE-2051) EFFECT OF REACTOR CHANNELING ON THE NEUTRONS EFFECTIVE BREEDING RATIO. Yudkevich, M. S. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Atomnoi Energii). 1971. 24p. (In Russian). INIS.

The effect of voids on the effective breeding ratio of a reactor is not readily calculable, and for small voids it is reasonable to take advantage of perturbation theory. However during calculations using the latter there arise difficulties in making allowance for spatial neutron transfer as long as the neutron diffusion coefficient in a vacuum reverts to infinity. Another method is proposed which obviates this difficulty; the perturbation factor in this case is the elimination of an arbitrary portion of the reactor. A program for computing K_{eff} for a cylindrical reactor with a void of rectangular cross section is offered. (tr-auth)

29786 (IAE-2158) SINGLE-GROUP CALCULATION OF REACTOR REACTIVITY COEFFICIENTS, PROMPT NEUTRON LIFETIME, AND AN EFFECTIVE PORTION OF DELAYED NEUTRONS. KR Program. Savchuk, Yu. I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Atomnoi Energii). 1971. 24p. (In Russian). INIS.

Perturbation theory was used in the derivation of single-group relations; these and the KR program solved the problem of determining the reactivity coefficient for a reactor, the lifetimes of prompt neutrons, and the effective fraction of delayed neutrons. The problem was solved in three dimensions for a non-homogeneous reactor of the VVER type. (tr-auth)

29787 (JAERI-M-4953) EXPANDA-70D: A ONE-DIMENSIONAL DIFFUSION CODE FOR MULTIGROUP CRITICALITY AND PERTURBATION CALCULATIONS WITH JAERI-FAST SETS OF 70 GROUP STRUCTURE. Hasegawa, A.; Katsuragi, S.; Tone, T. (Japan Atomic Energy Research Inst., Tokyo). Aug 1972. 72p. (In Japanese). NTIS (U. S. Sales Only).

Using the JAERI-Fast (70) group constants system as library data, the EXPANDA-70D one-dimensional criticality and perturbation calculation code has been developed. The code can treat not only the library data of JAERI-Fast (70) group constants system but also the library data of any group structure less than 70 groups obtained through the J-FAST-70U utility system producing any group-structure library data from the original 70-group JAERI-fast set. The XPRTC code used for calculation of the integral data is also described. (auth)

29788 (MRR-101) NEW FAST-WORKING DIGITAL METHOD FOR SPECTRUM ANALYSIS OF LARGE FREQUENCY RANGES. Hoermann, H. (Technische Universitaet, Munich (West Germany)). Mar 1972. 105p. (In German). INIS.

A new digital method for power density spectrum estimation of stationary random signals in power reactors is described. Because of low computing time and memory requirements the method is well suited for on-line applications and allows the quasi-simultaneous analysis of frequency ranges. The aptitude and efficiency are demonstrated by comparing the results of some power spectra estimations with calculations of other analysis methods. The program is written in FORTRAN-IV language. (INIS)

29789 MEASUREMENTS OF RESONANT NEUTRON FLUXES OF A REACTOR IN THE KILOVOLT REGION. Cherenda, N. G.; Bilan, O. N. (Inst. of Physics, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 5-7(1972). (In Russian).

The problem of the measurement of neutron fluxes in the keV region is discussed. The general features of methods used are described. The results of using the sandwich procedure and the ^{10}B filter techniques are given. (auth)

29790 MEASUREMENTS OF SPECTRAL INDICES IN A CLOSE-PACKED $U_{nat}O_2-H_2O$ SUBSTITUTION LATTICE USING FILTERED AND NON-FILTERED ACTIVATION FOILS. Schumann, P.; Albert, D. (Wissenschaften zu Berlin, Rossendorf, Ger.). Kernenergie; 15: No. 10, 344-347(Oct 1972). (In German).

Spectral indices were measured in a close-packed $U_{nat}O_2-H_2O$ substitution lattice ($V_{H_2O} : V_{UO_2} = 0.160$) using the activation indicators ^{164}Dy, ^{151}Eu, ^{63}Cu, ^{197}Au, ^{176}Lu. Additional information has been obtained by use of Gd filters in combination with Dy, Eu, Lu, and In probes yielding data on the region between thermal and epithermal neutron spectra. (auth)

29791 DISTRIBUTION OF ENERGY RELEASE FROM REACTOR FUEL RODS. Ponomarev-Stepnoi, N. N.; Krutov, A. M.; Lobyntsev, V. A.; Nosov, V. I. At. Energ. (USSR); 34: No. 3, 197-198(Mar 1973). (In Russian).

Results are presented of theoretical and experimental studies of the distribution of the release of energy along the radius of the core of a fuel rod. The measurement of the relative distribution of the scalar thermal neutron flux as a function of the azimuthal

angle at the boundary between the moderator and the fuel substance was performed. The calculated results showed satisfactory agreement with the experiment. (KSW)

29792 NUMERICAL METHOD FOR CALCULATING NEUTRON TRANSPORT THEORY FOR FAST REACTORS. Pavelescu, M.; Anton, V.; Purica, I. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 17: No. 10, 1109-1120(1972).

A numerical method is presented for the calculation of multizoned fast reactors in the transport approximation of the neutron-transport equation related to the possibility of using the theory of games to optimize the initial breeding ratio. The method solves a new approach of the critical state. It provides the matrices of gain and loss of a bimatrix game. The main results obtained by the SN35 code written in FORTRAN-1900 for an ICL computer are given. Metallic fuel is considered only. (auth)

29793 DELAYED NEUTRON DATA FOR FAST REACTOR ANALYSIS. Cahalan, J. E.; Ott, K. O. (Purdue Univ., Lafayette, Ind.). Nucl. Sci. Eng.; 50: No. 3, 208-215(Mar 1973).

The delayed neutron precursor decay curves which result from a pulse of fissions of the isotopes ^{233}U, ^{235}U, ^{238}U, ^{232}Th, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu are consistently fit to a single set of six isotope-independent decay constants. When delayed neutron yields based on a single set of group decay constants are employed in reactor transient analysis, it becomes possible to introduce macroscopic precursor production cross sections for each of the delayed neutron groups. The newly fitted data are tested by the analysis of a typical fast reactor transient; the analysis shows that the utilization of the new data in comparison to the use of original data results in an insignificantly small deviation, while permitting a considerable reduction of calculational effort. The new technique developed for the fitting is shown to preserve important integral kinetics parameters. The fitting technique also allows the recasting of original five group data into the more conventional six group structure. Recent measurements on the energy dependence of delayed neutron yields and emission spectra are briefly discussed. The lack of energy dependence of the total delayed neutron yield in the range of interest for fast reactor analysis leads to a modification of the definition of the effective delayed neutron fraction. (auth)

29794 APPLICABILITY OF SJOESTRAND'S AREA METHOD FOR REACTIVITY MEASUREMENT BY THE PULSED-NEUTRON TECHNIQUE. Dragt, J. B. Nucl. Sci. Eng.; 50: No. 3, 216-219 (Mar 1973).

One usually assumes that Sjoestrand's area method for determination of reactivity by the pulsed-neutron technique is only valid in case of exponential prompt-neutron decay and no kinetic distortion. The method is shown to be valid more generally. Namely, for all systems satisfying multigroup multinode reactor equations, with only one fissioning node, the method holds true exactly when reactivity is understood to be the static reactivity, while β_{eff} is defined as the relative difference between the static prompt and total multiplication factors, provided the sensitivity of the detector has the same energy dependence as the fission cross section of the fuel of the active zone. It follows, e.g., that Sjoestrand's method with a suitable fission counter is very well suited for measurement of subcriticality in small reflected subcritical fast cores. Some general recommendations are given. (auth)

29795 ERRORS IN PERTURBATION CALCULATIONS. McCallien, C. W. J. (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucl. Sci. Eng.; 50: No. 3, 290-293(Mar 1973).

Exact and first-order perturbation formulas that give changes in the eigenvalue of the discrete multigroup neutron diffusion equation are obtained. Various errors arising during the evaluation of these formulas are discussed. It is shown that for exact theory to give greater precision than first-order theory the fluxes must be sufficiently well converged to display the changes in them due to the perturbation. (auth)

29796 SOURCE-MULTIPLICATION METHOD FOR ABSOLUTE REACTIVITY DETERMINATION. Greenspan, E. (Israel Atomic Energy Commission, Beersheba). J. Nucl. Energy; 27: No. 3, 129-138(Mar 1973).

A new method for reactivity determination is presented. It involves two measurements of the reactor response to a neutron source: when subcritical, the source-multiplication, M, is measured and when critical, the linear power rise, R, is measured. The reactivity is then determined from the relation $\rho/\bar{\beta} = R/M \{1/(\bar{\beta}/\Lambda) + \Sigma_i[(\bar{\beta}_i/\bar{\beta})/\lambda_i]\}$, or from a good approximation to it $\rho/\bar{\beta} \approx T_d[R/M]$. This method is compared with the asymptotic-period method; expected accuracy is discussed, and possible measurement procedures are described. The feasibility of combining both methods for the determination of $\bar{\beta}/\Lambda$ is discussed. (auth)

29797 KINETICS OF THE PULSED FAST REACTOR CRITICAL ASSEMBLY WITH TEMPERATURE FEEDBACK. Das, S.; Srinivasan, M. (Bhabha Atomic Research Centre, Trombay, India). pp 561-578 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Inst. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29798 CALCULATION OF K_{eff} FOR BARE CYLINDER AND HEXAGONAL GEOMETRIES. Godwal, B. K.; Subbukutty, K.; Iyengar, S. B. D. (Bhabha Atomic Research Centre, Trombay, India). pp 585-588 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29799 MAXIMIZATION OF DESIRED ACTIVITY AGAINST INTERFERING ACTIVITIES IN THRESHOLD REACTIONS. Joneja, O. P.; Ramakrishna, D. V. S.; Navalkar, M. P. (Bhabha Atomic Research Centre, Trombay, India). pp 589-593 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29800 MEASUREMENT OF FAST FISSION RATIOS IN NATURAL UO_2 CLUSTERS. Jain, H. M.; Deniz, V. C. (Bhabha Atomic Research Centre, Trombay, India). pp 603-608 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

29801 INVERSE KINETICS ANALYSIS OF POWER-TIME TRACE DATA OF HEAVY WATER REACTORS. Srinivasan, M. (Bhabha Atomic Research Centre, Trombay, India). pp 609-617 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bombay, February 1-4, 1972. Bombay; Dept. of Atomic Energy (1972).

From nuclear physics and solid state physics symposium; Bombay, India (1 Feb 1972). See CONF-720221-(Vol.14B).

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Refer also to abstract 29845.

29802 (ANL-7958) LITHIUM/SULFUR BATTERIES FOR OFF-PEAK ENERGY STORAGE: A PRELIMINARY COMPARISON OF ENERGY STORAGE AND PEAK POWER GENERATION SYSTEMS. Kyle, M. L.; Cairns, E. J.; Webster, D. S. (Argonne National Lab., Ill.). Mar 1973. Contract W-31-109-eng-38. 116p. Dep. NTIS $5.45.

The use of lithium/sulfur batteries as load-leveling devices in electrical utility networks could provide both economic and ecological benefits in meeting the growing demand for energy. A battery designed for this application should have an initial capital cost of $12 to $15/kW-hr of energy storage capacity and a lifetime of at least five years. A typical duty cycle is expected to be a 10 to 14 hr discharge followed by a 4 to 8 hr charge with the battery operating about 5 days per week. Economic and cell performance goals for the development of a battery system are presented. A preliminary comparison of the costs of batteries, pumped hydroelectric storage and gas turbines indicates that, under some conditions, batteries should be considered as load-leveling devices. The lithium/sulfur battery system is in too early a state of development to accurately predict its place in the utility system. However, consideration of current laboratory cell performance and projected battery costs indicates that further research to determine if a viable system can be developed is warranted. (auth)

29803 (CONF-730115-1) POWER PLANTS, TRANSMISSION LINES, AND THE NORTH AMERICAN ENVIRONMENT. Burgess, R. L. (Oak Ridge National Lab., Tenn.). 1973. 21p. Dep. NTIS $3.25.

From symposium on preparing environmental reports for nuclear power plants; Monterey, California, USA (22 Jan 1973).

The effects of the increased usage of electricity on the environment were discussed. More land is needed for rights-of-way. Transmission lines cut across or through a variety of ecological habitats. The site locations for nuclear or conventional power plants are limited by physiographic conditions. The aesthetic effect is staggering in some cases. The use of pesticides and herbicides under the power lines presents ecological concern. Cases were cited of the danger of the power line towers falling when, for example, a helicopter severed the guy. (JCW)

29804 (CONF-730205-1) TRANSPORTATION ENERGY USE AND CONSERVATION POTENTIAL. Hirst, E. (Oak Ridge National Lab., Tenn.). 1972. 22p. Dep. NTIS.

From conference on energy, demand, conservation, and institutional problems; Cambridge, Massachusetts, United States of America (USA) (12 Feb 1973).

The reasons were discussed why an investigation was made of transportation energy use. Transportation of people and goods consumes one-fourth of the total USA energy budget. Second, world oil reserves appear to be limited. Third, the USA transportation system is almost entirely dependent on oil as a fuel. Fourth, exploration, production, transportation, refining, and use of petroleum present serious environmental problems such as accidental spillage, air pollution, and thermal emissions. Finally, transportation contributes to environmental problems including urban congestion, inefficient land use, and noise. (JCW)

29805 (LBL-923) SOLAR RADIATION AND LIFE. Calvin, M. (California Univ., Berkeley. Lawrence Berkeley Lab.). Aug 1972. Contract W-7405-eng-48. 38p. (CONF-720854-1). Dep. NTIS.

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972).

It seems possible, by using the "photoelectrochemical" method, even with the 1 cal/cm^2/sec, that is available on the Earth's surface, to generate electrical energy in quantities sufficient to be useful and economic. An area 100 mi sq (10^4 square miles of Arizona desert, for example) covered with this type of material could produce the total energy needs of the Earth today. About 2 volts are generated, in a very thin system, and the problem of collection is very difficult. At the present time, 96% of the U. S. energy is coming from fossil fuels (oil, natural gas, coal). It is shown that the U. S. domestic oil supply is already not adequate for the needs of the population, and natural gas may last another ten years, and then will start to be inadequate. Twenty years from now nuclear power will be very important as an energy source, and even that source will decline within another hundred years. Solar energy and fusion may be the methods of the future to ensure the energy supply for the world. Solar energy can be captured by an engineering method (a thermal engine), or the silicon converter developed by the physicists, the photoelectrochemical method being developed by chemists, and the development and evolution of more efficient and more useful biological energy capturing systems and converters. (JCW)

29806 (ORNL-NSF-EP-44) ENERGY INTENSIVENESS OF PASSENGER AND FREIGHT TRANSPORT MODES: 1950 TO 1970. Hirst, E. (Oak Ridge National Lab., Tenn.). Apr 1973. Contract W-7405-eng-26. 46p. Dep. NTIS $4.50.

Previous work at ORNL evaluated the energy consequences of changes in freight and passenger traffic levels and shifts in modal mix for the period 1950 to 1970. The research extends this work to include an analysis of changes in energy intensiveness for individual modes during this period. Examination of individual modes shows that airplanes are energy-intensive and that cars and trucks are less so. Buses, mass transit, railroads, pipelines, and boats are relatively energy-efficient. Railroad energy intensiveness dropped sharply during this 20-year period because of the shift from steam engines to diesel engines. On the other hand, airplane energy intensiveness increased rapidly because of increased speed. Other modes generally showed slight increases in energy intensiveness. Energy intensiveness of inter-city freight declined during this period because of the large drop in railroad energy intensiveness. However, passenger transport became more energy intensive because of shifts to airplanes and autos and because of a general increase in energy intensiveness for all passenger modes. Results derived here are summarized in a number of ways to highlight important shifts in energy use patterns for transportation. (auth)

29807 GEOTHERMAL WORLD DIRECTORY. Meadows, K. F. (ed.). Glendora, CA; Katherine F. Meadows (1972), 190p.

A reference source of current data and related material on geothermal activities around the world was compiled. The geothermal programs of Italy, Japan, Iceland, New Zealand, Mexico, and the U. S. S. R. are primarily a governmental responsibility. The Big Geysers in California is the only private, investor-owned operating geothermal plant in the world. Geothermal potentials cannot supply more than a modest portion of energy needs, but there is sufficient profit to provide the incentive for expansion. (JCW)

29808 ENERGY, ECOLOGY, ECONOMY. Garvey, G. New York; W. W. Norton and Company, Inc. (1972). 235p. $8.95.

The adverse environmental effects of growing levels of energy use cost the American people billions of dollars yearly, although the effects cannot be appraised accurately. A new framework is developed for assessing the long-term destruction caused during the production, transportation, and conversion of fuel to meet the heavy demands for energy. The discussion is presented in 10 chapters: Accenting the Positive; Depletive Waste: An Intergenerational Externality; Energy and Ecology; Appalachian Reckoning: The Environmental Costs of Coal; Petroleum Out of Place; Air Pollution in the Urban Ecosystem; Nuclear Power; Water Quality; Improving the Energy Order: The Role of Technology; and Eliminating the Negative. (JCW)

29809 PROCEEDINGS OF THE AMERICAN POWER CONFERENCE. Volume 34. Thirty-fourth annual meeting, Chicago, Illinois, April 18–20, 1972. Chicago; American Power Conference (1972). 1132p. (CONF-720465–). $20.00.

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

Papers presented are grouped under the following session headings: general interest, nuclear, mechanical, industrial, water technology, hydroelectric, and electrical. Separate entries were prepared for 46 papers. Five papers were previously abstracted for NSA. (MCG)

For abstracts of individual papers see: 29810–29829.

29810 ENGINEERING CONSIDERATIONS OF COMBINED CYCLES. Priddy, A. P.; Sullivan, J. J. (Chas. T. Main, Inc., Boston). Proc. Amer. Power Conf.; 34: 282-291(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465–.

The combined cycles and their place in the USA utility industry are discussed. The combined cycles are comprised of gas

turbine-generators, heat recovery boilers, and steam turbine-generators. The range of possible plant capacities, cycle variations, and variety of equipment that are available suggest that the needs of individual utilities, with respect to available fuels, capacity requirements, site limitations, or available equipment, can be satisfied. The impact of combined-cycle plants on the environment is considered to be less, particularly in the area of water quality. Fast-start capability, the ability to operate the gas turbines independently of the steam turbine, and the technology with lower-grade fuels suggest a plant more flexible than heretofore. (JCW)

29811 SELECTION AND DESIGN OF A NEW COMBINED-CYCLE PLANT: STAG. Swed, R. J. (G.P.U. Service Corp., Parsippany, NJ); Wood, R. G. Proc. Amer. Power Conf.; 34: 292-301(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

General Public Utilities made an evaluation in 1970-1971 of the combined-cycle plants and purchased a STAG (Steam and Gas Turbine Combined Cycle) plant and located it on the New Jersey Power and Light Company system at the Gilbert Generating System. The STAG plant will have summer (95 F) and winter (30 F) ratings of 310 MW and 367 MW, respectively, at base load and 322 MW and 391 MW, respectively, at peak loads, and has a maximum capability of 433 MW at the minimum site ambient of -20 F. (JCW)

29812 UNIQUE COMBINED-CYCLE SYSTEM TO MEET UTILITY INTERMEDIATE CYCLING LOADS. Boland, C. R.; Patterson, R. D. (Turbo Power and Marine Systems, Inc., Farmington, CT). Proc. Amer. Power Conf.; 34: 302-309(1972)

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The unfired 125-MW combined-cycle plant utilizing the Pratt and Whitney FT4 Gas Turbine Engine was developed to meet the need for a midrange power plant that would have minimum adverse ecological effect, high operating efficiency, low initial capital investment, high availability, minimum order to in-service time, maximum shop assembly with resulting minimum of field erection, and ease of operation and maintenance. (JCW)

29813 DESIGN AND DEVELOPMENT OF HIGH-PRESSURE MODULAR HEAT RECOVERY STEAM GENERATORS FOR GAS TURBINE-STEAM TURBINE COMBINED CYCLES. Sokolowski, P. F.; Schwartz, D. A. (Westinghouse Electric Corp., Lester, PA). Proc. Amer. Power Conf; 34: 310-330(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

A description was given of the HRSG (Heat Recovery Steam Generator) for the PACE 260 Combined-Cycle Plant under construction for Public Service Company of Oklahoma. Computer programs were used to gain specifications for a basic design. Then it takes the gas turbine exhaust conditions and desired steam conditions and designs an HRSG that will give the specified back-pressure on the gas turbine. A program is being developed that will predict the response of the HRSG system to any change. (JCW)

29814 INCREASED PLANT KILOWATTS USING TURBINE-DRIVEN BOILER FANS. Williamson, E. L. (Southern Services, Inc., Birmingham, AL); Black, J. C.; Destribats, A. F.; Iuliano, W. N.; Reed, F. A. Proc. Amer. Power Conf.; 34: 346-353(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

Large net plant kilowatt gains are available with turbine-driven boiler fans for plants that will use a maximum loaded main turbine-generator. Thermodynamic considerations are discussed in Part I and in Part II, mechanical and economic factors involved are discussed. Variable-speed turbine-driven fans are compared with motor driven fans with inlet vane controls. (JCW)

29815 EFFECT OF FUEL AVAILABILITY ON FUTURE R AND D PROGRAMS IN POWER GENERATION. Hauser, L. G.; Comtois, W. H.; Boyle, R. R. (Westinghouse Electric Corp., Pittsburgh). Proc. Amer. Power Conf.; 34: 374-389(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

A forecast was made of the future energy consumption of the electric utility industry. Most research effort should be in power generation that utilizes coal or nuclear fuel as the raw energy source. Coal and nuclear fuel will supply 85% of the electric energy generated in 1990. Gas and oil will be in short supply before 1990. Plutonium recycling will be utilized in fuel management. The LMFBR should be developed. (JCW)

29816 COST SEPARATION OF STEAM AND ELECTRICITY FOR A DUAL-PURPOSE POWER STATION. Leung, P. (Bechtel Corp., Los Angeles). Proc. Amer. Power Conf.; 34: 390-404 (1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The basic energy source for process steam and electricity production is the heat from (combustion or fission). The cost of fuel must be charged to the process steam and electricity. Computation methods based on thermodynamic and economic principles and on an operating and maintenance cost separation method are discussed. Economic considerations of the choice between a company-owned dual-purpose plant and the purchase of steam and electricity elsewhere are also discussed. The examples are for fossil-fired cycles, but are applicable to nuclear steam turbine cycles. (JCW)

29817 COAL GASIFICATION FOR ELECTRICAL POWER. Matthews, C. W. (Inst. of Gas Tech., Chicago). Proc. Amer. Power Conf.; 34: 503-511(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

Coal burned as a fuel is a primary contributor to the sulfur and nitrogen oxides pollutants in the atmosphere. Installation of aqueous scrubbing systems for the cleaning of stack gases from coal-fired boilers will provide short-term control of this important source of air pollution from power plants. The HYGAS Process for gasification of coal to produce synthetic pipeline gas is described, and may be applied to other high-pressure coal gasification processes. Discussions are given on low-BTU gas production from gasification, and combined-cycle systems are ideal to consider as an advance power system for use with coal gasification. (JCW)

29818 BINARY-CYCLE POWER PLANTS USING AIR-COOLED CONDENSING SYSTEMS. Steigelmann, W. H.; Seth, R. G.; Wachtell, G. P. (Franklin Inst. Research Labs., Philadelphia). Proc. Amer. Power Conf.; 34: 521-530(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

A comparison is presented of the cost of generating electricity in each of five plants investigated as a function of fuel cost. The use of a once-through cooling system gives the lowest-cost electricity, while the use of wet cooling towers shows a moderately higher cost. The three plant concepts that use dry cooling towers have higher generating costs, with both the binary-cycle concept and the "hybrid system" showing lower cost than the "conventional-system" plant. Of particular significance is the fact that, for fuel costs greater than about $20¢/10^6$ Btu, the cost of electricity is less for steam turbines using ammonia in the heat-rejection system (the hybrid system) than for the binary-cycle power plants. (JCW)

29819 BASIC SAFETY AS RESPECTS STORAGE, MOVEMENT, AND COMBUSTION OF GAS AND OIL FUELS. Vinson, B. M. (Oil Insurance Association, Dallas). Proc. Amer. Power Conf.; 34: 591-609(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

Proper plant engineering is basic, and safety factors must be adhered to. Safety instrumentation to detect some improper safety performance must be well maintained. General requirements for all storage is outlined. Care necessary for the movement of gas and oil fuels is discussed. Safety is discussed in detail for gas- or oil-fueled steam generating facilities in the capacity range to 600,000 lbs/h. Oil Insurance Association reports that 67% of the loss frequency and 73% of the total damage for all startup explosions are caused by human error. Thirty-seven percent of the loss frequency and 67% of the total damage for all on line explosions are caused by human error. (JCW)

29820 GENERATING USABLE STEAM FROM THE INCINERATION OF MUNICIPAL AND INDUSTRIAL PROCESS WASTES. Wennerstrom, J. M. (Babcock and Wilcox Co., Barberton, OH). Proc. Amer. Power Conf.; 34: 642-648(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The heat produced in the incineration process can be recovered and used for heating, processing, or power generation from a boiler generating steam. The reclamation unit for the production of steam used by the City of Nashville, Tennessee is described. This is as-received nonresidential refuse. The unit for municipal garbage for the City of Hamilton, Ontario is described. Units utilizing coffee grounds and wood wastes are described. (JCW)

29821 DEVELOPMENT OF INTERCONNECTED EHV SYSTEMS IN BRAZIL. De Moraes, J.; Peixoto, C. A. O. (Furnas, Centrais Electricas S.A., Rio de Janeiro). Proc. Amer. Power Conf.; 34: 829-835(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

Extra-High-Voltage (EHV) transmission has found a wide field of application in Brazil, not only due to this country's continental dimensions, but also due to available hydroelectric potential being far from load centers, and alternative conventional thermal power not economically viable because of the relative scarcity of known fossil-fuel reserves. Development of Brazil's EHV transmission system commenced in 1959, and has been expanded continuously at an average annual rate of 10 percent. Both UHV-AC and EHV-DC are in future development. (JCW)

29822 FRENCH 400-kV TRANSMISSION SYSTEM: PRESENT STATE, EVOLUTION FORECASTS WITH INTRODUCTION OF A HIGHER VOLTAGE. Auge, J.; Bergougnoux, J.; De Calbiac, J.; Pouget, J. (Electricite de France, Paris). Proc. Amer. Power Conf.; 34: 836-843(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The voltage level of the 400-kV network in France has lasted 30 years. A forecast of a 730-kV network appears to be good for France and it would be highly desirable if the choice were to be common to the whole of Europe. Geography and environment are the parameters to be considered by neighboring countries. (JCW)

29823 SWEDISH EHV TRANSMISSION SYSTEM: PAST AND FUTURE. Jancke, G.; Johansson, T.; Edberg, O. (Swedish State Power Board, Vallingby). Proc. Amer. Power Conf.; 34: 844-852(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The Swedish 400-kV network has been characterized with a good economy and operational safety and with great flexibility when extending the system. It has been possible to raise the transmission capacity of the lines to 2 BIL, despite the fact that the primary lines are often about 300 miles long. This network has served to transmit large quantities of energy over long distances from remotely situated hydropower resources. Future growing electricity consumption will be covered mainly by nuclear power plants. A voltage level of 750 kV has been found to be the most suitable for Sweden's network for the future. (JCW)

29824 DEVELOPMENT OF EHV AND UHV SYSTEMS IN THE USSR. Lyskov, Y. I. (All-Union State Research and Design Inst. on Electrical Network and Power Systems, Moscow); Rokotyan, S. S.; Bourgsdorf, V. V.; Mamikoniants, L. G. Proc. Amer. Power Conf.; 34: 853-858(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The total picture of interconnection of power systems and power transmission in the USSR is briefly surveyed. At the beginning of 1971, the total length of 35-kV and higher-voltage transmission lines was ~440,000 km; 362,000 km of these were distribution networks of 35 to 150 kV, 50,000 km were 200 kV, and more than 28,000 were 330 kV or higher. The majority of interconnected power systems is based on 500-kV lines. Experience with some 750-kV systems now operating is described. Since transmission capacity will increase two or three times in the next decade and reach 6000 MW at lengths of 1000 to 1200 km, the application of 1150 kV must be considered. Overlaying the existing network (500 kV) by 1150-kV lines will enable sectionalizing of the 500-kV network, which is necessary to reduce the short-circuit currents and to simplify system control. Design of the first section of the 1150-kV transmission line from Siberia to North Kasakhstan was started early in 1972. Also, 1500-kV dc transmission is being investigated, and problems related to both the 1150-kV ac and 1500-kV dc are briefly discussed. (LMT)

29825 UHV: PANACEA OR PANDORA'S BOX. Lawrence, R. F.; Cronin, J. H. (Westinghouse Electric Corp., Pittsburgh). Proc. Amer. Power Conf.; 34: 869-879(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

Conclusions show that to the total utility industry, on projected growth of transmission, there is an economic incentive for a UHV voltage, e.g., 1100 kV. The use of larger size units and larger plants well into the 5000-MW range is foreseen through the 1980's. Inherent potential savings to the utility are in the economy of scale of the higher-voltage transmission lines. Reliability, environmental impact and efficient land use, transmission efficiency, and radio interference are to be considered. (JCW)

29826 ENVIRONMENTAL FACTORS IN SITING TRANSMISSION FACILITIES. Barthold, L. O.; Puntel, W. R.; Ringlee, R. J. (Power Technologies, Inc., Schenectady, NY). Proc. Amer. Power Conf.; 34: 880-887(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The economics of aesthetic accommodations during the siting of electric power transmission facilities is discussed. The interaction between generation site philosophy and transmission requirements is illustrated. (JCW)

29827 COMMONWEALTH EDISON'S FIRST 765-kV INSTALLATION. Christensen, L. H. (Commonwealth Edison Co., Chicago). Proc. Amer. Power Conf.; 34: 888-895(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

December 1, 1971 was the in-service date for Commonwealth Edison Company's first 765-kV line. From this first interconnection there will be a 765-kV grid around Chicago, with additional interconnections to the north, south, east, and west. (JCW)

29828 HIGH-VOLTAGE DESIGN AND 735-kV TRANSMISSION FOR THE CHURCHILL FALLS HYDROELECTRIC DEVELOPMENT. Thom, R. H. P. (Churchill Falls Corp., Ltd., Montreal); Tomlinson, H. M.; Sauve, G. G.; Volckmar, C. W. Proc. Amer. Power Conf.; 34: 896-903(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

The Churchill Falls Hydroelectric Development is harnessing the upper Churchill River in central Labrador in the Province of Newfoundland, Canada. The 5225 MW that will be generated from the 11 generators, each rated 475 MW will mainly be supplied to Hydro-Quebec except for about 250 MW used in Labrador. The overall electrical design concept for the plant is conventional except possibly for the use of 735 kV for the transmission voltage and the resulting effects on line and switchyard design. The three single-circuit 735-kV transmission lines, each having a length of 126 miles, connect the plant to the extensive Hydro-Quebec EHV transmission system. (JCW)

29829 PLANNING THROUGH SIMULATION OF OPERATING WITH NUCLEAR AND FOSSIL PLANTS. Hoskins, R. E. (Tennessee Valley Authority, Chattanooga); Koncel, E. F.; Strauch, S. Proc. Amer. Power Conf.; 34: 1008-1016(1972).

From 34th annual meeting of the American power conference; Chicago, Illinois, USA (18 Apr 1972).

See CONF-720465-.

A system integration model interrelates developments, the inputs, and the output goals. Nuclear refueling scheduling, maintenance scheduling, power system simulation and optimization, and reactor simulation are discussed. Iterative procedures examined are dynamic programming, linear programming, quadratic programming, and a limited form of exhaustive search called accelerated search. 27 references. (JCW)

29830 EFFICIENCY OF ENERGY USE IN THE UNITED STATES. Hirst, E.; Moyers, J. C. (Oak Ridge National Lab., TN). Science; 179: No. 4080, 1299-1304(30 Mar 1973).

Three uses of energy for which greater efficiency is feasible include transportation, space heating, and air conditioning. In the USA in 1970, transportation of people and freight consumed 25% of total energy, primarily as petroleum. Space heating of homes and commercial establishments was the second largest end-use, consuming 18%. Industrial uses of energy (process steam, direct heat, electric drive, fuels used as raw materials, and electrolytic processes accounted for 42%. The remaining 15% was used for water heating, air conditioning, refrigeration, cooking, lighting, operation of small appliances, etc. (JCW)

29831 ENGINEERING SOLUTIONS TO ENVIRONMENTAL PROBLEMS. Miller, R. B. (Iowa-Illinois Gas and Electric Co., Davenport, Iowa). Proc. Iowa Acad. Sci.; 79: No. 3-4, 135-137 (Dec 1972).

The environmental problems are largely associated with what is called the "good life" with leisure time, low cost of goods, lots of modern conveniences, etc. This means the convenience of prepackaged foods, throw-away containers, and all kinds of disposables. The free time gives lots of time for travel, recreation, etc. We can afford it because of mass production made possible primarily by electrical energy. Travel needs lots of transportation: automobiles, airplanes, etc. Income has gone up faster than costs, and spendable income has increased. All of this is based on technology. The engineer helped create this situation, and he must now help the population to understand the situation and to seek out ways to resolve this matter in an enlightened fashion, and help the population to understand it. Priorities must be set and costs weighed. (JCW)

29832 LIMITS TO ENERGY RELEASE AND IMPLICATIONS FOR PRESENT POLICY. Barus, C. (Swarthmore Coll., PA). J. Eng. Ind.; 95: No. 1, 383-390(Feb 1973).

Today much of technology is serving affluence rather than basic needs, yet worldwide poverty remains a dominant human problem. Perpetual technological growth is still seen by many as the solution to this problem. Though energy sources may prove to be virtually infinite, energy sinks and pollutant sinks are finite. Engineers have a responsibility to plan for such limitations. The capacity of the atmosphere as a heat sink remains an ultimate geophysical limit to energy release by man. Various writers have estimated the order of magnitude of this limit. Some of these estimates are discussed. Possible modes of approach to a limit are considered in the light of current trends, published predictions, and the problem of meeting human needs. It is found that U. S. planning for an orderly and equitable transition to a fixed-energy-rate economy is already overdue. (auth)

29833 ENERGY CONSERVATION. Some Challenges Are Proposed for Science and Technology. Lincoln, G. A. Science; 180: No. 4082, 155-162(13 Apr 1973).

The objective is to enlist the interest of thinking people in the energy conservation effort. Continuation of the present rate of increase of the use of energy will lead to a level of dependency on imports that is disturbing for both the national security and the balance of payments. The inevitable rise in the price of energy will presumably lead to some increases in the domestic energy supply. The forthcoming rise in fuel prices will make more attractive some forms of conservation that at present are economically marginal. Existing capabilities and technology on which short- and midterm improvements must be based, appear to offer substantial possibilities for reducing US energy consumption within the next decade. (23 references). (JCW)

29834 ENERGY CRISIS. Part 2. Tapping the Sun. Opt. Spectra; 7: No. 3, 27-29; 34-38(Mar 1973).

The research being performed on the conversion of solar radiation into energy was reported. Tyco Laboratories Inc. at Waltham, Massachusetts, is doing materials research aimed at bringing down the cost of manufacturing silicon solar cells. Dr. Peter Glaser from Arthur D. Little, Inc., Cambridge, Massachusetts, is doing research on direct conversion of solar energy for heating and cooling and on conversion to electric power. The furnace is situated at Phoenix, Arizona. Dr. Erich Farber, University of Florida, established a laboratory in 1954 that includes an all solar house and a solar car. The University of Minnesota and Honeywell, Inc., are active in research in solar heating and air conditioning. The long- and short-term goals are discussed. (JCW)

29835 SOLAR ENERGY UTILISATION FOR HOT WATER. Baker, J. G. Copper (Geneva); No. 4, 18-22(1972).

A description was given of the systems in Australia for the production of hot water from solar radiation. Systems presently exist in a major hospital, several hotels, and several large boarding schools. An efficient system can be obtained by using correctly designed absorber panels, properly designed flow and return pipe systems, and having adequately sized storage tanks to suit the quantity of water required. Copper is a major component in the construction of solar heating panels for hot water and air heating systems. (JCW)

29836 SUPERCONDUCTIVITY: STORAGE OF ENERGY. Carpetis, C.; Hess, R. (Inst. fuer Energiewandlung und Elektrische Antriebe, Stuttgart). Umsch. Wiss. Tech.; 73: No. 2, 55-56(1973). (In German).

A superconducting coil represents an excellent electrical storage system with a stored energy per mass unit 100 times better than a conventional capacitor. The technical and physical problems and some possible future applications are described. Another very interesting method of nonconventional energy storage bases on the possible stabilization of hydrogen atoms of high density at very low temperatures and high magnetic fields. The background of this chemical storage system with the highest enthalpy per mass unit of all nonnuclear reactions is briefly reported. (auth) (GF)

29837 LAB SPURS CABLE R AND D. Cryog. Ind. Gases; 8: No. 1, 29-32(1973).

Studies of materials and design parameters for an underground ac superconducting cable system will be made in a new high-voltage testing laboratory installed at Union Carbide Corp., Tarrytown, N. Y. The effort is the huge potential power transmission capacity of a superconducting cable. Conventional cables are approaching their upper load-carrying limit in the neighborhood of 500 MVA, but by refrigerating a superconducting cable with liquid helium, electrical losses in the cable essentially vanish. The potential capacity of the superconducting cable is over 10,000 MVA. (JCW)

29838 PROTOTYPE PROVES POWER PLANT PROMISE. Cryog. Ind. Gases; 8: No. 1, 21-22; 25-26(1973).

A five megawatt superconducting ac generator has been developed and preliminary testing conducted at Westinghouse Electric Corporation. The basic machine utilizes a superconducting field winding contained in a rotating dewar system and an oil-cooled air gap stator winding. Future generations of this prototype will be more efficient, cheaper to build, and 70 to 90% smaller than their conventional counterparts now operating in electrical power plants throughout the land. (JCW)

29839 NUCLEAR POWER AND THE ENVIRONMENT. Grendon, A. Forum (Chicago); 8: No. 1, 70-92(Fall 1972).

Nuclear fission provides a new source of energy to supplement the older resources, principally fossil fuels and water power. The energy of nuclear fission is currently being applied as heat to make steam to run turbines and generate electricity; but plans are well advanced to use the heat also for distillation of salty or brackish water in order to augment diminishing water supply and to use steam from nuclear reactors in industrial processes and domestic heating. Proposals for the use of waste heat to prevent the undesired freezing of lakes and to enhance the productivity of farm lands by warm water irrigation abound. Power plants of all types carry a certain amount of undesirability. Power plants require large structures, land for transmission lines that need broad and long rights-of-way, and large volumes of condenser cooling water and a means of disposing of the heat it absorbs. Reactor types are discussed. Alternatives to nuclear fission include expanded use of fossil fuel plants; expanded use of hydroelectric plants; development and use of solar power, geothermal sources, tidal power, wind, and fusion nuclear power. (JCW)

29840 ENVIRONMENTAL PROBLEMS IN CONNECTION WITH POWER PRODUCTION. Faux, F. (Central Electricity Generating Board, London). Elektrizitaetswirtschaft; 69: No. 24, 643-653(1970). (In German).

Some of the problems arising from the demand for further power plants (including nuclear power plants) and high-power transmission lines and their unavoidable influences on the environment were investigated. Legal and other obligatory conditions that have to be fulfilled by the constructors and operators of power plants with regard to environmental protection are compiled and discussed with reference to all member states of Unipede. (GF)

29841 ENERGY USE IN THE UNITED STATES, 1880–1966. Nash, R. T.; Williamson, J. W. (Vanderbilt Univ., Nashville). Fuel; 51: No. 4, 258-266(Oct 1972).

Their historical study of energy use in the United States was conducted by examining the use for each State. Because of the extensive amount of data, the results have been presented for each of nine regions that are designated by the US Bureau of Census, in the years 1880, 1915, 1940, and 1966. Changing patterns of energy use are traced through this period. As a direct result, evidence is presented to show that use/head increases abruptly during periods of mechanization and industrialization, and then changes very slowly subsequently. Further, these results are used to show how better methods for forecasting energy needs can be developed. Past and future projections of the US energy needs are examined in the light of these historical results. The importance of the end use of energy, land use, and population in forecasting energy needs is emphasized. (auth)

29842 SUPERCONDUCTIVE ENERGY STORAGE FOR POWER SYSTEMS. Boom, R. W.; Peterson, H. A. (Univ. of Wisconsin, Madison). IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.; 8: No. 3, 701-703(Sep 1972).

The use of large superconducting inductors for "pumped" energy storage as an alternate to pumped hydro-storage is discussed. It is suggested that large units might be developed at less than $200/kW and with losses less than the 50 percent representative of pumped hydrostorage. Particular notice is taken of the ability of such peaking units to damp overall power system electromechanical oscillations. Attention is also given to the stress considerations in magnet windings and to the optimization of superconductor and structural material. A preliminary analysis is made for a 400 MW to 10,000 MWh unit. (auth)

Law

Refer also to abstract 29840.

29843 (NP-19665) REPORT ON THE DEVELOPMENT OF THE SOCIAL SITUATION IN THE COMMUNITY IN 1971. (European Communities, Brussels (Belgium). Commission). Feb 1972. 316p. Dep. NTIS (U.S. Sales Only).

Addendum to NP-19348.

The addendum to the fifth general report on the activities of the Communities is a report on the development of the social situation in the Community in 1971. Development of the social situation includes discussions on employment; vocational guidance and training; industrial relations; labor conditions and law; wages and asset formation; housing; family problems; social services; social security; safety, health, and hygiene; and health protection. A statistical appendix is included. (JCW)

29844 (NP-19683) CALIFORNIA'S ELECTRICITY QUANDARY: II. Planning for Power Plant Siting. Ball, R. H.; Salter, R. G.; Dole, S.; Frederich, B.; Hammer, M.; Mooz, W. E.; Papetti, R.; Richards, G. (Rand Corp., Santa Monica, Calif.). Sep 1972. 114p.

A large number of new power plants are going to be required in California in the next few decades if growth in demand continues unabated, and it is questionable that the supply system will be able to locate suitable sites and construct enough new plants to meet that demand. The purpose of the study was to examine and evaluate alternative siting options for power plants in order to define the criteria and methods useful to a state siting agency in the site-selection process. When it became clear that the legislature was interested in establishing a power plant siting agency, new issues examined were critical issues in establishing effective policy and the alternative structures, functions, and procedures for a siting agency. Today environmental impacts have amplified due to the great size of the systems. Permits for new power plants have been blocked, and the state is confronted with competing demands by power companies, on the one hand, who want to build power plants to prevent energy crises, and conservationalists, on the other who perceive an environmental crises in the pollution of air and water and the use of valuable land. (JCW)

29845 ELECTRICITY AND THE ENVIRONMENT. The Reform of Legal Institutions. St. Paul; West Publishing Company (1972). 346p.

The Special Committee on Electric Power and the Environment on behalf of the Association of the Bar of the City of New York submits its analysis and reconciliation, to the extent possible, on the nation's need for an adequate supply of electric energy and the need to conserve and protect the environment. Advice is summarized from industrial, administrative, environmental, technological, and governmental personnel in eight discussions including the nature of the problem stated in the prologue; the relation of electricity to the economy and the environment; an overview and a critique of the decision-making processes; the demand for electricity and energy; a summary of the current legislative reform approaches; and recommendations summarized in seven issues on demand, capacity and regional allocation, land use, generation and transmission alternatives, environmental standards, safety, and research and development. (JCW)

29846 NUCLEAR POWER STATIONS. 1. Authorities Responsible for Radiation Protection and Risks Connected with Radiation. Lindell, B.; Tribukait, B. Laekartidningen; 68: No. 39, 4355-4360(22 Sep 1971). (In Swedish).

A survey is given of the prognosis of the electrical energy demand in Sweden up to the year 2000 as well as the possible ways of producing it. The procedure of reactor licensing and the different authorities involved are described shortly. Finally, the risks connected with low doses of radiation on the human population are surveyed. (Sweden)

29847 NEW TRENDS IN NUCLEAR LAW. Pfaffelhuber, J. K. Bull. Droit Nucl.; No. 10, 44-59(Nov 1972). (In French).

The regulations in vigor concerning nuclear law and its practical administration are examined. Three aspects are considered: legal aspects, aspects concerned with their execution, organizational aspects. The legal aspects concern the industrial exploitation of national territory and the determination of sites for implanting nuclear installations; the planning and authorization procedures and their efficient operation; the defining of the limits covered by nuclear law as opposed to those concerning the legislation relative to protection against noxious radiations and to water sources; the ratification of the Paris Convention on civil liability in the field of nuclear energy together with those of the complementary Brussels Convention; the revision of legislation on protection against radiations. The execution aspects concern: the decisions reached by the federal authorities in collaboration with the Commission on reactor safety, nuclear standards, and discussions during enquiry procedures. The organizational aspects concern the high federal authorities responsible for reactor safety and protection against radiations. (FR)

29848 KAERNKRAFTEN, MAENNISKAN OCH SAEKERHETEN. (Nuclear Power, Man, and Safety). Lindell, B.; Loefveberg, S. Stockholm; Allmaenna Foerlaget (1972). 446p.

The nuclear power extracted from fission by means of peaceful reactors or by explosive devices is discussed on a level for the layman. Radioactive materials as sources of radiation, their physical characteristics, their behavior in the ecological systems and the problems associated with radioactive wastes are considered. Radiation and its impact upon man are presented: biological consequences of radiation, attitudes (imprudence and misunderstanding) and accidents. Safety regulations are discussed and especially their implementation in Sweden, as laws, authorities, and procedures. (SW)

Management

Refer also to abstracts 27888, 27991, and 29853.

29849 (KFK-1740) PERSONAL INQUIRY SYSTEM IN APL. Wilhelmi, G. (Kernforschungszentrum, Karlsruhe (West Germany)). Jan 1973. 35p. (In German). Dep. NTIS (U.S. Sales Only) $3.75.

29850 (NP-19664) REPORT FOR THE YEAR 1970/71. (Statens Rad for Atomforskning, Stockholm (Sweden)). 1972. 136p. (In English and Danish). Dep. NTIS (U.S. Sales Only).

Brief notes are given on atomic scientific research in Sweden. Awarded grants 1970/71 are listed. The Swedish participation in the European organization for nuclear research (CERN) and in the Nordic Institute for Theoretical Atomic Physics in Copenhagen is summarized. (Sweden)

29851 (UCRL-74605) AFFIRMATIVE ACTION TRAINING PROGRAM FOR FIREMEN. MacBain, Z. E. (California Univ., Livermore. Lawrence Livermore Lab.). 7 Mar 1973. 19p. Dep. NTIS $3.00.

Mathematics and Computers

29852 (CEA-N-1591) RANDOM POINTS ON A LINE: MEAN SQUARE DEVIATION OF THE NUMBER OF POINTS FOUND IN A GIVEN INTERVAL. Mehta, M. L. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Jan 1973. 12p. (In French). Dep. NTIS (U.S. Sales Only) $3.00.

29853 (CONF-721026-) AESOP CONFERENCE, VOLUME 7, IDAHO FALLS, IDAHO, OCTOBER 3-5, 1972. (Idaho Operations Office (AEC), Idaho Falls). [nd]. 283p. Dep. NTIS.

The AESOP was formed to promote the interchange of information among AEC and its contractors, related to administration, commercial, and industrial data processing. The seventh meeting was hosted by the Aerojet Nuclear Company at Idaho Falls, Idaho, on Oct. 3-5, 1972. Twenty-eight papers were presented dealing with computer information; hardware, software, or peopleware. (JCW)

29854 (ITF-72-158-P) CIRCULAR ORBITS IN THE TWO-PARTICLE DYNAMICS TAKING INTO ACCOUNT RETARDED IN-

TERACTIONS. Zhdanov, V. I.; Piragas, K. A. (Akademiya Nauk Ukrainskoi SSR, Kiev. Institut Teoreticheskoi Fiziki). 1972. 22p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.25.

29855 (ITF-72-188-P) APPLICATION OF ERGODIC RELATIONS TO THE INHOMOGENEOUS SYSTEM WITH "WEAK INTERACTION". Prikhod'ko, V. I. (Akademiya Nauk Ukrainskoi SSR, Kiev). Institut Teoreticheskoi Fiziki). 1972. 22p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.25.

29856 (KFK-EXT-13/72-5) COMPUTER NETWORK STATE DESCRIPTION AND STATE SUPERVISION. Drobnik, O.; Holler, E.; Schumacher, F.; Sell, F. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Datenverarbeitung in der Technik). Dec 1972. 44p. (In German). Dep. NTIS (U.S. Sales Only) $4.25.

29857 (NP-19696) SIMULATION BY COMBINATORIAL MANIPULATION OF FREQUENCY DISTRIBUTIONS. Petrich, G. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Datenverarbeitung in der Technik). Aug 1972. 16p. (In German). Dep. NTIS (U.S. Sales Only) $3.00.

29858 (NVO-1253-2) HYDROLOGIC DATA STORAGE AND RETRIEVAL SYSTEM. User Information Bulletin 1. Friesen, H. N. (Nevada Univ., Reno. Desert Research Inst.). Jun 1972. Contract AT(29-2)-1253. 26p. Dep. NTIS $3.50.

Hydrologic data has been collected from various USAEC test sites and a computerized system for storage and retrieval of this data has been implemented as an aid to geologic and hydraulic investigations. The system has been designed with emphasis placed on ease of user retrieval. A diversified set of statistical routines has been included in the system to provide the user with a wide choice of post-retrieval data manipulation. (auth)

Miscellaneous

29859 (AAEC/E-219(Pt.3)) POTENTIAL-pH DIAGRAMS AT TEMPERATURES ABOVE 298.16°K. Part 3. Potential-pH Diagrams of Aluminium for the Temperature Range 298.16 to 573.16°K. Lowson, R. T. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Oct 1972. 30p. Dep. NTIS (U. S. Sales Only) $3.00.

29860 (AECL-4367) ENDURANCE TESTS ON LARGE HYDROSTATIC (CONICAL-FACE) AND HYDRODYNAMIC (TAPER-FACE) ROTATING SHAFT SEALS IN PRESSURIZED WATER. Watson, R. D. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs). Jan 1973. 52p. Dep. NTIS (U.S. Sales Only) $4.75. AECL $1.50.

29861 (AWRE-O-50/72) COMPARISON OF THE SEISMIC EFFECTS PRODUCED BY A FALLING WEIGHT AND DETONATIONS OF SMALL, BURIED, EXPLOSIVE CHARGES. Grover, F. H.; James, E. W. (Atomic Weapons Research Establishment, Aldermaston (England)). Oct 1972. 24p. Dep. NTIS (U.S. Sales Only). UK 50 pence.

29862 (BARC-630) RATES OF ENERGY TRANSFER IN EUROPIUM CHELATES. Joshi, B. D.; Page, A. G.; Patel, B. M. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 22p. Dep. NTIS (U. S. Sales Only) $3.25.

29863 (BNL-17572). ROLE OF POLYMER IN POLYMER-IMPREGNATED CONCRETE. Auskern, A.; Horn, W. (Brookhaven National Lab., Upton, N. Y.). Jan 1973. 27p. Dep. NTIS.

29864 (BNWL-SA-3556(Rev.1)) CORROSION EDUCATION PROGRAMS FOR COMMUNITY COLLEGES. Perrigo, L. D.; Pratton, D. L. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). 1971. Contract AT(45-1)1830. 10p. (CONF-711070-1). Dep. NTIS.

From Western region conference of the National Association of Corrosion Engineers; Honolulu, Hawaii, USA (5 Oct 1971).

29865 (BNWL-SA-3984) EVALUATION OF WATER FLUX COMPONENTS ABOVE A DEEP WATER TABLE USING THERMOCOUPLE PSYCHROMETERS. Enfield, C. G.; Hsieh, J. J. C.; Warrick, A. W. (Battelle Pacific Northwest Labs., Richland, Wash.). Aug 1971. Contract AT(45-1)-1830. 17p. (CONF-710852-1). Dep. NTIS.

From national agronomy meeting; New York, NY (15 Aug 1971).

29866 (BNWL-SA-4160) PARTICLE COLLECTION EFFICIENCIES ON CYLINDRICAL WIRES. Sehmel, G. A. (Battelle Pacific Northwest Labs., Richland, Wash.). Jun 1972. Contract AT(45-1)-1830. 13p. (CONF-720673-1). Dep. NTIS.

From 1st international meeting on pollution; Tel Aviv, Israel (12 Jun 1972).

29867 (BNWL-SA-4161) PARTICLE DEPOSITION AND DIFFUSIVITIES ALONG SMOOTH SURFACES. Sehmel, G. A. (Battelle Pacific Northwest Labs., Richland, Wash.). Jun 1972. Contract AT(45-1)-1830. 10p. (CONF-720673-2). Dep. NTIS.

From first international meeting on pollution; Tel Aviv, Israel (12 Jun 1972).

29868 (BNWL-SA-4324) PARTICLE EDDY DIFFUSIVITIES AND DEPOSITION VELOCITIES FOR SMOOTH SURFACES. Sehmel, G. A. (Battelle Pacific Northwest Labs., Richland, Wash.). Jun 1972. Contract AT(45-1)-1830. 31p. (CONF-720673-3). Dep. NTIS $3.75.

From first international meeting on pollution; Tel Aviv, Israel (12 Jun 1972).

29869 (BNWL-SA-4578) AUTOMATED SMALL CALIBER AMMUNITION CASE SURFACE FLAW INSPECTION SYSTEM. Coleman, W. J.; Erickson, M. D.; Reich, F. R. (Battelle Pacific Northwest Labs., Richland, Wash.). Jan 1973. 17p. (CONF-730410-1). Dep. NTIS.

From 28th annual division meeting on American Ordnance Association; Redstone Arsenal, Alabama, USA (11 Apr 1973).

29870 (CALT-767-P-3-29) COMMENTS ON THE MEASUREMENT OF DISLOCATION MOBILITY AND THE DRAG DUE TO PHONONS AND ELECTRONS. Vreeland, T. Jr.; Jassby, K. M. (California Inst. of Tech., Pasedena. W. M. Keck Lab. of Engineering Materials). 1972. 19p. Dep. NTIS.

29871 (CALT-767-P-3-30) EXPERIMENTAL MEASUREMENT OF THE DRAG COEFFICIENT. Vreeland, T. Jr.; Jassby, K. M. (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). 1973. Contract AT(04-3)-767. 13p. (CONF-730112-1). Dep. NTIS.

From metallurgical effects of high strain rates conference; Albuquerque, New Mexico, USA (4 Jan 1973).

29872 (CALT-822-49) CRYSTALLIZATION OF $Te_{100-x}Tl_x$ ALLOYS ($15 \leq x \leq 50$) OBTAINED BY RAPID COOLING FROM THE LIQUID STATE. Anseau, M. R. (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). Dec 1972. Contract AT(04-3)-822. 7p. Dep. NTIS.

29873 (CEA-CONF-2148) OBTAINING SHOCKS BY ELECTRODYNAMIC DISCHARGES. Magne, M. (Commissariat a l'Energie Atomique (France). Centre d'Etudes Scientifiques et Techniques d'Aquitaine). 1972. 18p. (In French). (CONF-721139-4). Dep. NTIS (U.S. Sales Only).

From conference on environmental science and technology; Versailles, France (22 Nov 1972).

29874 (CEA-N-1567) STUDY OF THE BEHAVIOR OF CRYSTAL DEFECTS USING A MONTE-CARLO METHOD. Application to Quench Simulation. Lanore, J. M. (Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires). Dec 1972. 15p. (In French). Dep NTIS (U. S. Sales Only) $3.00.

29875 (CEA-R-4366) STUDY OF SECONDARY SLIP MODES IN MAGNESIUM. Stohr, J. F. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Mar 1973. 97p. (In French). Dep. NTIS (U.S. Sales Only) $7.00.

Thesis. Submitted to Paris Univ., Orsay, France.

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From 13th ASME, ASM annual symposium; Albuquerque, New Mexico, USA (1 Mar 1973).

29877 (COO-1792-5) LUMINESCENCE STUDIES WITH SPECIAL REFERENCE TO BIMOLECULAR PHENOMENA. (Final Report), May 1, 1968-August 31, 1971. Krishna, V. G. (Arizona Univ., Tucson). 1972. Contract AT(11-1). 1972. 10p. Dep. NTIS.

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From symposium on numerical fluid dynamics; Hampton, Virginia, Colombia (19 Oct 1972).

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29883 (EUR-4947) EFFECT OF MACROPOROSITY DISTRIBUTION IN INDUSTRIAL ELECTROGRAPHITES ON MECHANICAL RESISTANCE. Lanza, F.; Marengo, G. (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). Apr 1973. 20p. (In Italian). Dep. NTIS (U.S. Sales Only) $3.00. EUR BF 40.-.

29884 (FEI-335) TECHNIQUE FOR THE CALCULATION OF VELOCITY AND PRESSURE FIELDS IN A PLANE COLLECTOR. Nomofilov, E. V.; Pomanova, T. M.; Filimonov, V. T. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Obninsk. Fiziko-Energeticheskii Institut). 1972. 21p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.25.

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29888 (ISS-72/11) COMPUTER PROGRAM FOR THE ANALYSIS OF MASS SPECTRA OF GaTe AND GaSe. Martinangeli, A. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 26 Jul 1972. 30p. (In Italian). Dep. NTIS (U.S. Sales Only) $3.50.

29889 (IS-T-576) HALL MOBILITY AND MAGNETORESISTANCE OF n-TYPE MAGNESIUM GERMANIDE. Li, P. W. (Ames Lab., Iowa). Feb 1973. Contract W-7405-eng-82. 68p. Dep. NTIS $5.50.

29890 (JINR-P4-6862) ELASTIC CONSTANTS AND STABILITY OF ANHARMONIC CRYSTALS. Plakida, N. M.; Aksenov, V. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1972. 16p. (In Russian). Dep. NTIS (U. S. Sales Only).

29891 (JINR-P4-6900) ON THE VIBRATION SPECTRUM OF THE CRYSTAL WITH ADSORBED ATOMS ON THE FREE SURFACE. Karaivanov, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1973. 10p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

29892 (LA-5037) SPONTANEOUS IGNITION. Finite Element Solutions for Steady and Transient Conditions. Anderson, C. A.; Zienkiewicz, O. C. (Los Alamos Scientific Lab., N. Mex.). Jan 1973. Contract W-7405-eng-36. 14p. Dep. NTIS.

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